

MO
CON. WI
8:W-13-R-34
/41

FINAL REPORT
SURVEYS AND INVESTIGATIONS PROJECTS

As Required By
FEDERAL AID IN WILDLIFE RESTORATION ACT

MISSOURI

Federal Aid Project No. W-13-R-34 (1980)

STUDY NO. XLI: Evaluation of Upland Wildlife Management Practices
for Importance to Non-Game Birds

Job No. 1: Evaluation of upland wildlife management practices
for importance to non-game birds

By

Richard L. Clawson

Larry R. Gale, Director

Charles A. Purkett, Jr., Assistant Director

Dean A. Murphy, Chief, Wildlife Division

MISSOURI DEPARTMENT OF CONSERVATION

Dan F. Dickneite
P-R Coordinator

April 20, 1981

Bill T. Crawford, Supt.
Wildlife Research Section

PERMISSION TO QUOTE

This is a final report. To prevent the issuing of misleading information, persons wishing to quote from this report, to cite it in bibliographies or to use it in other forms should first obtain permission from the project leader under whose direction the work was performed, or from the research superintendent.

FINAL REPORT
SURVEYS AND INVESTIGATIONS PROJECTS

STATE OF MISSOURI

Project No. W-13-R-34 (1980)

Study No. XLI

Job No. 1

Study No. XLI: Evaluation of Upland Wildlife Management Practices for Importance to Non-Game Birds

Job No. 1: Evaluation of upland wildlife management practices for importance to non-game birds

ABSTRACT

This report discusses the methods and findings of a study designed to yield information on the effects of upland wildlife management on non-game birds. Data are presented from breeding bird and winter bird censuses of 17 study plots in 3 cover types: cropland, grassland and woodland. The results of Breeding Bird Surveys and Christmas Bird Counts on the Whetstone Creek Wildlife Area also are presented.

Croplands were used by a wide variety of birds throughout the year, although nesting habitat was somewhat limited. The primary nesting guilds were the ground, low shrub and herbaceous nesters. All foraging guilds were represented; the primary groups were the ground, shrub, canopy, herbaceous and flycatching foragers. Croplands with shrubby draws or multiflora rose strips had the highest number of species and highest densities during both the breeding and wintering seasons. While the cropland plots had fewer nesting species and lower densities during the breeding season than woodland plots had, they had the highest numbers of species and densities during the winter. Croplands should be divided into small units. Herbaceous and woody cover should be developed within and adjacent to croplands to provide nesting and foraging substrates and winter cover for non-game birds.

Many of the species that occurred on the cropland plots also occurred on the grassland plots. The primary nesting guilds were the herbaceous, low shrub and ground nesters. The primary foraging guilds were the ground, shrub and flycatching foragers. Moderate grazing increased nesting densities. Cover establishment and food strips in grasslands would enhance non-game bird use throughout the year.

The woodland plots were occupied by different species of birds than occurred in the open cover types. All nesting and foraging guilds were represented on woodland plots. The primary nesting guilds were the canopy and low shrub nesters. The primary foraging guilds were the canopy, shrub and ground foragers.

ABSTRACT (cont'd):

Openings in the forest canopy attract old field and edge species and are used as foraging areas by forest interior birds. Standing dead trees attract cavity nesters and bark feeders and provide song and foraging perches for other species. Trees left standing in clear cuts provide song perches, foraging perches and nest sites.

In order to include all of the data that were collected during this study in a single report, it was necessary to present it in a form that has little utility as a management guide. We recognize the need to take relevant portions of this study and prepare a report detailing specific management recommendations for non-game birds that will be useful to land managers. Such a report will be forthcoming.

FINAL REPORT
SURVEYS AND INVESTIGATIONS PROJECTS

STATE OF MISSOURI

Project No. W-13-R-34 (1980)

Study No. XLI

Job No. 1

Study No. XLI: Evaluation of Upland Wildlife Management Practices for
Importance to Non-game Birds

Job No. 1: Evaluation of upland wildlife management practices for importance
to non-game birds

Objective:

To measure and evaluate the response of upland non-game birds to nine wildlife management practices employed on four state-owned areas in central Missouri.

Introduction:

Traditional wildlife management has focused on harvestable species. With increased public interest and awareness of environmental conditions, emphasis is shifting toward a community or ecosystem approach that considers all wildlife when choosing among management alternatives. It will be the responsibility of the land manager to provide for the needs of a broad spectrum of wildlife. Critical examination of each management technique for its effects on wildlife, both target and non-target species, is necessary to form a basis on which the manager can make his decisions. This project is designed to determine how several wildlife management practices affect non-game birds.

Seventeen study plots in cropfields, grassland units, and forest areas were established on 4 wildlife management areas in central Missouri: 5 on Rudolph Bennitt, 2 on Prairie Home, 2 on Reform, and 8 on Whetstone Creek. The prefix of each study plot refers to the wildlife area on which it occurs (B = Rudolph Bennitt; P = Prairie Home; R = Reform; W = Whetstone Creek).

Techniques Used:

METHODS

Winter censuses were conducted by walking a grid pattern on each study area and recording all birds seen and heard. Three counts were made on each plot. A Christmas Bird Count (CBC) was conducted on Whetstone. The area was divided into 5 units and observers canvassed each during the morning hours on the CBC count day in late December.

Summer residents were estimated by conducting standard Breeding Bird Censuses (Robbins 1970) on the study areas. Grid lines 73m (80 yards) apart were established on each area. The observer walked slowly along

Techniques Used (cont'd):

the lines, pausing frequently to note the locations and behavior of birds on the plots. These were plotted on maps of the study areas. After 5 early morning counts a composite map was prepared for each plot. Clustering of the observations indicated territory presence and location. Birds that did not appear to be defending territories were included in the data set but were treated as "observed only" (as opposed to being reported in number of territories per study area). The censuses were conducted in May and June. A survey patterned after the Breeding Bird Survey (Robbins and Van Velzen 1967) has been established on Whetstone. Using the roads on the area, a 19 km (11.8 miles) route containing 25 stops of 3 minutes each was run on an early morning during the first week of June. All birds seen and/or heard during the stops were recorded.

Vegetation on the study areas was sampled following the method of James and Shugart (1970). Circular plots 0.04 ha in size were randomly placed in all vegetation types except active cropland. After the center point was located, 2 lines running north-south and east-west were established, thus dissecting the plot into quarters. The observer walked the lines taking 20 measurements of each of the following: canopy and subcanopy closure by sighting through an ocular tube; ground cover and height by blindly placing a meter stick at arm's length to one side and noting the type and height of the tallest live vegetation touching the stick; litter cover and depth with the meter stick by recording the height of the tallest piece of vegetation from the previous year's growth that touched the stick. The number of woody stems taller than 1 m and less than 2.5 cm dbh was determined by walking the lines and counting all stems within 1 m either side of the line (a subsample of 0.008 ha). All living and dead trees greater than 2.5 cm dbh were measured with a Biltmore stick and recorded by size class. The percent ground cover in grass, forbs and woody types was ocularly estimated. Maximum canopy height was estimated using the Biltmore stick. Slope and aspect were noted for each vegetation plot.

STUDY AREAS

Cropland -- W-1 was a 16.2 ha plot. It contained 9.3 ha of active crop strips and strips composed of crop residue, annual vegetation from the previous growing season, and 6.9 ha of grass/shrub draw. The noncrop portion of the study area exhibited 92% ground cover that consisted mostly of grasses and forbs. It had 95% litter cover and 815 woody stems per ha (Table 1). The crops and annuals were laid out in strips on the contour. It was bordered on the north and west by grass/shrub fencelines, on the east by a gravel road, and on the south by continued cropland and a pond (Figure 1).

W-2 was a 16.2 ha plot. It contained 10.5 ha of active crop strips and strips of residual crop and annuals, and 5.7 ha of shrub/tree draw. The noncrop portion of the study area had 94% ground cover (mostly

Techniques Used (cont'd):

forbs), 89% litter cover, and 1,040 woody stems per ha (Table 1). The crops and annuals were laid out in contour strips. It was bordered on the west, south, and east by grass/shrub fencelines, and on the north by continued crop and draw (Figure 1).

W-3 was a 16.2 ha plot. It contained 15.8 ha of active crop strips, strips of residual crop and annuals, and 0.4 ha of grass/shrub draw. The noncrop portion of the study area had 85% ground cover (mostly forbs), 71% litter cover, and no woody growth (Table 1). The crops and annuals were laid out in contour strips. It was bordered on the west, north, and east by grass/shrub fencelines and shrub/tree fenceline, and on the south by continued cropfield (Figure 1).

P-1 was an 8.9 ha plot. It contained 5.3 ha of crop strips, 3.2 ha of annuals, and 0.4 ha of multiflora rose hedges. The crops and annuals were laid out in strips divided by 6 sinuous rose hedges. The noncrop portion of the study area had 94% ground cover (mostly grasses), 81% litter cover, and 422 woody stems per ha (Table 1). Because the multiflora rose strips were not amenable to the sampling technique employed on the other cover types, they were sampled separately. The strips averaged 2.6 m in height, 3.8 m in width, and were composed of 33% live and 67% dead canes. It was bordered on all sides except part of the east by woodlots and shrub/tree fencelines. It contained 2 small ponds (Figure 1).

P-2 was a 11.3 ha plot. It contained 8.9 ha of crop and 2.4 ha of fescue. The noncrop portion of the study area had 92% ground cover (mostly forbs), 95% litter cover, and 74 woody stems per ha (Table 1). It was bordered on all sides by shrub/tree fencelines and a woodlot. It contained 1 pond (Figure 1).

Grassland -- R-1 and R-2 were managed by grazing for 5 months of the year. The units were subdivided into thirds and the cattle rotated between areas, with no more than 2 months spent in any subunit. Portions of each unit were selected for study. Cattle had access to and grazed each study plot, but were not restricted solely to the study plots. The subunits were labeled a,b, and c. All units were grazed heavily during 1977, prior to Department control. Grazing rotation began in 1978.

R-1a was a 5.7 ha plot. It had 100% ground cover (mostly grasses), 100% litter cover, and 86 woody stems per ha (Table 2). It was bordered on the west and east by shrub/tree fencelines, on the north by grass/shrub fencelines, and on the south by fescue. R-1a and R-1b adjoined on their west and east sides, respectively. R-1b was a 7.7 ha plot. It had 100% ground cover (mostly grasses), 99% litter cover, and 136 woody stems per ha (Table 2). It was bordered on the west by a woodlot and a pond, on the north and east by shrub/tree fencelines, and on the south by continued fescue. R-1c was a 6.5 ha plot. It had 100% ground cover (grass and forbs), 98% litter cover, and 148 woody stems per ha (Table 2). It was bordered on the west and north by fescue and a pond,

Techniques Used (cont'd):

on the east by a row of cedars, and on the south by shrub/tree fenceline (Figure 2).

R-2a was a 12.1 ha plot. It had 100% ground cover (mostly forbs), 100% litter cover, and 716 woody stems per ha (Table 2). It was bordered on the north and east by shrub/tree fencelines and on the south and west by grass/shrub fenceline. It contained 1 pond. R-2b was an 8.5 ha area. It had 99% ground cover (mostly grasses), 98% litter cover, and 62 woody stems per ha (Table 2). It was bordered completely by grass/shrub fencelines. R-2b and R-2c adjoined on their north and south side, respectively. R-2c was an 8.9 ha plot. It had 99% ground cover (mostly grasses), 99% litter cover, and 12 woody stems per ha (Table 2). It was bordered completely by grass/shrub fencelines (Figure 2).

W-4 was a 15.0 ha ungrazed fescue field. It contained 11.7 ha of grass and 3.3 ha of crop strips approximately 600 m long by 40 m wide on the contour. The grassy portion had 100% ground cover (mostly grasses), 100% litter cover, and 49 woody stems per ha (Table 2). It was bordered on the north by a grass/shrub fenceline, on the east by a row of cedars, and on the south and west by continued fescue. It contained 1 pond and 3 brushpiles. W-4 and W-5 adjoined on their west and east sides, respectively (Figure 2).

W-5 was a 16.2 ha ungrazed fescue field. It contained 15.8 ha of grass and 1 0.4 ha crop strip. It had 100% ground cover (mostly grasses), 99% litter cover, and 99 woody stems per ha (Table 2). It was bordered on the north by a grass/shrub fenceline, on the east and south by continued fescue, and on the west by a shrub/tree fenceline and a woodlot. It contained 2 brushpiles, a service road, and a clump of 6 trees from an abandoned house site (Figure 2).

Woodland -- W-6 was a 16.2 ha plot of formerly grazed oak-hickory forest. It had 84% canopy closure, 40% subcanopy closure, 67% ground cover (mostly forbs and grasses), 1,107 woody stems per ha, and 99 ft.² per ac basal area (Table 3). It contained 1 pond and was bordered on the east by an intermittent stream. On the west it was bordered by fescue pasture and woods, on the north by woods, and on the south by a cleared area grown up in annuals (Figure 3). The forest/open edges were abrupt.

W-7 was a 6.9 ha ungrazed oak-hickory woodlot with several grass/shrub/cedar openings. It had 81% canopy closure, 44% subcanopy closure, 61% ground cover (mostly woody and forbs), 951 woody stems per ha, and 91 ft.² per ac basal area (Table 3). It was bordered on the west by a cropfield, on the north by a gravel road, and on the east and south by old fields (Figure 3). The edges were abrupt.

W-8 was a 16.2 ha plot of ungrazed oak-hickory forest. It had 83% canopy closure, 46% subcanopy closure, 57% ground cover (mostly woody), 2,581 woody stems per ha, and 76 ft.² per ac basal area (Table 3). A finger of native grass extended into the plot. It was bordered on the west by an overgrown native grass area and woods and on all other sides by woods (Figure 3).

Techniques Used (cont'd):

B-1 was a 1.2 ha food plot completely surrounded by woods. One third of the area (0.4 ha) was cropped and 0.8 ha was in annuals. Shrubs and saplings occurred around a small pond. The noncrop portion of the study area had no canopy, 7% subcanopy closure, 97% ground cover (mostly grasses and forbs), 98% litter cover, 536 woody stems per ha, and 3 ft.² per ac basal area (Table 3; Figure 3).

B-2 was a 3.2 ha plot that was clear cut in 1974 except for 3 living and 4 dead trees that were left standing. It had 10% canopy closure, 42% subcanopy closure, 92% ground cover (evenly composed of grasses, forbs and woody), 10,460 woody stems per ha, and 8 ft.² per ac basal area (Table 3). It was completely surrounded by woods (Figure 3).

B-3 was a 2.8 ha plot in which most of the trees were killed by girdling and chemical injection but left standing in 1974. It had 19% canopy closure, 17% subcanopy closure, 99% ground cover (mostly forbs and woody), 4,076 woody stems per ha, and 65 ft.² per ac basal area (30 ft.² live and 35 ft.² dead timber) (Table 3). It was completely surrounded by woods (Figure 3).

B-4 was a 2.4 ha untreated forest plot. It had 63% canopy closure, 47% subcanopy closure, 99% ground cover (mostly grasses and woody), 6,694 woody stems per ha, and 91 ft.² per ac basal area (Table 3). It was completely surrounded by continued woods (Figure 3).

B-5 was a 1.6 ha untreated forest plot. It had 62% canopy closure, 41% subcanopy closure, 88% ground cover (evenly composed of grasses, forbs and woody), 2,816 woody stems per ha, and 63 ft.² per ac basal area (Table 3). It was completely surrounded by woods (Figure 3).

Findings and Analysis

VEGETATION

The vegetation data were subjected to cluster analysis (Numerical Taxonomy System of Multivariate Statistical Programs by Rolph, Kishpaugh and Kirk). The program measured the distances between the means of all parameters and then grouped the study areas based upon those distances. The results are presented in a dendrogram (Figure 4). Even though it doesn't show discrete measures of the vegetation, a dendrogram is useful in visually representing or summarizing the similarity of the plots because it lists them in a dendritic array from least to most similar.

The system segregated the closed canopy plots (forested areas) from the open plots (cropfield and grassland areas) (Figure 4). The distance between the means (or, conversely, their overall similarity) is represented by vertical distance on the dendrogram: the higher the horizontal line above the plots, the less similar they were. Examining the closed canopy plots, W-7 and W-8, the ungrazed plots, were more similar to

Findings and Analysis (cont'd):

each other than they were to W-6, the grazed plot, but the 3 Whetstone plots were more similar to each other than they were to any of the Bennitt plots (Figure 4). B-3, the girdle, was more similar to B-5, an untreated plot, than either was to B-4, the other untreated plot. However, all the above Whetstone and Bennitt plots grouped separately from B-2, the clear cut. This represented the major breakdown between forested plots.

Among the open plots, cropfields and grasslands were arrayed together. This is probably due to the fact that the actively cropped portions of the study plots were not sampled. Thus, factors that might have better separated cropfields and grasslands vegetatively such as bare ground and diversity (or lack of it) of vegetation types were not considered. However, due to disturbance and the lack of a suitable substrate for all but bare ground nesters, cultivation precludes nesting by most birds. Virtually all of the nesting that took place on cropfield plots occurred in the draws and strips of annuals and residual crops. This vegetation was similar to that found on the grassland plots and in the array the cropfield plots were interspersed with the grasslands (Figure 4).

Among the open plots, the largest division separated the 3 Whetstone cropfield plots, W-1, W-2 and W-3, as one group, R-2b, a grazed unit at Reform, by itself, and lumped the rest of the open areas into a third group (Figure 4). These groups were further broken down by the program until all plots were paired with a vegetatively similar plot. Of all the study plots, W-4 and W-5, ungrazed grasslands that were adjacent to one another, were the most similar in vegetation. B-1 was listed among the forest plots in the introduction because it was a food plot cleared out of bottomland woodlands at Bennitt. However, the vegetation analysis grouped it with the open plots and it was more similar to R-2c, a grazed grassland unit, than it was to any other plot in the study.

BIRDS

Tables 4-8 and 10-13 summarize the results of the 1978-1980 breeding bird censuses and 1979-1981 winter bird censuses of the study plots. The data are grouped by habitat type and management area so that one may compare treatments within habitat types on each management area and compare treatments in the different habitats between management areas.

Tables 4-6 summarize the results of the breeding bird censuses. Both the species determined by the Mapping Method to be nesting on the study plots and the species observed on the plots, but not determined to be nesting, are presented. The number of years each species was found on the study plots also is presented. The mean number of territories (all species combined) is presented, as is an extrapolation of that figure to the mean number of territories per hectare for comparison between

Findings and Analysis (cont'd):

treatments and study plots. The data are coded to identify the species using the study plots but not determined to be nesting (designated in the tables by an X), and those nesting on the study plots (designated by a numeral which denotes the mean number of territories found per year). Tables 7 and 8 show a breakdown of the different nesting and foraging strategies represented on the study plots. (For a listing of the species and their nesting and foraging patterns, see Appendix I.) The results of the Breeding Bird Survey on Whetstone in 1977-1980 are presented in Table 9.

Tables 10-12 summarize the results of the winter bird censuses. The number of years each species was observed on the study plots and the mean number observed per count per year are presented. The mean number of birds (all species) observed per count on each study plot is presented, along with an extrapolation of that figure to the mean number per hectare for comparison between treatments and study plots. Table 13 shows a breakdown of the different foraging strategies represented on the study plots. The results of the Whetstone Christmas Bird Count in 1978-1979 are presented in Table 14.

Breeding Season

BREEDING BIRD CENSUS

Cropfield -- W-1, which had grass/shrub draws, had 20 nesting species, a mean density of 2.5 territories per ha, and 15 species observed but not determined to be nesting (Table 4). It provided nesting habitat primarily for low shrub nesters (e.g. blue grosbeak), ground nesters (e.g. killdeer), and herbaceous nesters (e.g. dickcissel) (Table 7). It was used for all foraging patterns; the primary groups being ground foragers (e.g. common grackle), shrub foragers (e.g. common yellowthroat), and flycatching foragers (e.g. bank swallow) (Table 8).

W-2, which had shrub/tree draws, had 24 nesting species, a mean density of 3.1 territories per ha, and 10 species observed only (Table 4). It provided nesting primarily for low shrub (e.g. brown thrasher), herbaceous (e.g. red-winged blackbird), ground (e.g. bobwhite), and mid-story shrub nesters (e.g. mourning dove) (Table 7). It was used primarily by ground foragers (e.g. horned lark), shrub foragers (e.g. yellow-breasted chat), and canopy foragers (e.g. yellow-billed cuckoo) (Table 8).

W-3, which had strips of crops and annuals, had 13 nesting species, a mean density of 1.9 territories per ha, and 12 species observed only (Table 4). It provided nesting primarily for herbaceous (e.g. Indigo bunting), ground (e.g. grasshopper sparrow), and low shrub nesters (e.g. gray catbird) (Table 7). It was used primarily by ground (e.g. mourning dove), and shrub foragers (e.g. cardinal) (Table 8).

P-1, which had multiflora rose hedges, had 19 nesting species, a mean density of 3.2 territories per ha, and 16 species observed only (Table 4).

Findings and Analysis (cont'd):

It provided nesting primarily for low shrub (e.g. American goldfinch) and herbaceous nesters (e.g. field sparrow) (Table 7). It was used primarily by shrub (e.g. Bell's vireo), ground (e.g. brown-headed cowbird), canopy (e.g. orchard oriole), herbaceous (e.g. red-winged blackbird), and flycatching foragers (e.g. barn swallow) (Table 8).

P-2, the untreated cropfield, had 17 nesting species, a mean density of 2.3 territories per ha, and 13 species observed only (Table 4). It provided nesting primarily for low shrub (e.g. blue grosbeak), herbaceous (e.g. dickcissel), and ground nesters (e.g. bobwhite) (Table 7). It was used primarily by shrub (e.g. American goldfinch), ground (e.g. mourning dove), herbaceous (e.g. eastern meadowlark), and canopy foragers (e.g. blue jay) (Table 8).

The cropfield study plots were used by a wide variety of birds, but nesting habitat was somewhat limited. The primary groups that were observed nesting were the ground, low shrub and herbaceous nesters. Each plot also had at least 1 midstory shrub nester, 2 had canopy nesters, 1 had a primary cavity excavator (red-headed woodpeckers in a utility pole), and 2 had secondary cavity users (Table 7). All of the foraging patterns (guilds) were represented. The primary guilds were the ground, shrub, canopy, herbaceous, and flycatching foragers (Table 8). The importance of vegetation structure was evident. W-2, W-1 and P-1, with shrubby draws and multiflora rose strips, had the most species and highest nesting densities of the cropfield plots (Table 4).

Grassland -- W-4, the ungrazed grassland with food strips, had 23 nesting species, a mean density of 2.0 territories per ha, and 18 species observed only (Table 5). It provided nesting primarily for herbaceous (e.g. Henslow's sparrow), low shrub (e.g. American goldfinch), ground (e.g. horned lark), and midstory shrub nesters (e.g. eastern kingbird) (Table 7). It was used primarily by ground (e.g. grasshopper sparrow), shrub (e.g. brown thrasher), flycatching (e.g. purple martin), canopy (e.g. northern oriole), and bark foragers (e.g. hairy woodpecker) (Table 8).

W-5 the other ungrazed grassland, had 15 nesting species, a mean density of 1.7 territories per ha, and 20 species observed only (Table 5). It provided nesting primarily for herbaceous (e.g. common yellow-throat) and low shrub nesters (e.g. gray catbird) (Table 7). It was used primarily by ground (e.g. Henslow's sparrow), shrub (e.g. Indigo bunting), flycatching (e.g. rough-winged swallow), and canopy foragers (e.g. orchard oriole) (Table 8).

R-1, a grazed plot, had 25 nesting species, a mean density of 3.1 territories per ha, and 25 species observed only (Table 5). It provided nesting primarily for low shrub (e.g. brown thrasher) and herbaceous nesters (e.g. field sparrow) (Table 7). It was used primarily by ground (e.g. mourning dove), shrub (e.g. cardinal), and flycatching foragers (e.g. barn swallow) (Table 8).

Findings and Analysis (cont'd):

R-2, the other grazed plot, had 20 nesting species, a mean density of 3.5 territories per ha, and 19 species observed only (Table 5). It provided nesting primarily for herbaceous (e.g. red-winged blackbird) and low shrub nesters (e.g. yellow-breasted chat) (Table 7). It was used primarily by ground (e.g. grasshopper sparrow), shrub (e.g. blue grosbeak), canopy (e.g. blue jay), and flycatching foragers (e.g. eastern kingbird) (Table 8).

The grassland study plots also provided habitat for a wide variety of birds, many of which overlapped with the cropfield plots. The primary groups of nesting birds were herbaceous, low shrub and ground nesters. Each plot had 2 or more midstory shrub nesters, 2 had canopy nesters, 3 had primary cavity excavators, and 3 had secondary cavity users (Table 7). All of the foraging guilds were represented. The primary guilds were the ground, shrub, and flycatching foragers, with canopy, bark and herbaceous foragers well represented (Table 8). R-2 and R-1, the grazed plots, had the highest densities of nesting birds, while R-1 and W-4, an ungrazed plot with food strips, had the most nesting species (Table 5). Moderate grazing allowed some species, notably red-winged blackbird, eastern meadowlark, dickcissel, and grasshopper sparrow to nest in higher densities but did not eliminate any species.

Woodland -- W-6, the formerly grazed plot, had 40 nesting species, a mean density of 2.7 territories per ha, and 11 species observed only (Table 6). It provided for all nesting strategies; the most abundant were the canopy (e.g. scarlet tanager), low shrub (e.g. Kentucky warbler), and midstory shrub nesters (e.g. wood thrush), and the primary cavity excavators (e.g. pileated woodpecker), and secondary cavity users (e.g. great crested flycatcher) (Table 7). It was used by all foraging guilds; the primary guilds were the canopy (e.g. red-eyed vireo), shrub (e.g. cardinal), ground (e.g. American robin), bark (e.g. white-breasted nuthatch), and flycatching foragers (e.g. eastern wood pewee) (Table 8).

W-7, an ungrazed wood lot, had 31 nesting species, a mean density of 7.0 territories per ha, and 17 species observed only (Table 6). It provided nesting for all strategies but one; the numbers of species in each group were well distributed. The most abundant were the low shrub nesters (e.g. American robin) and primary cavity excavators (e.g. hairy woodpecker) (Table 7). It was used by all foraging guilds except one; the primary guilds were the shrub (e.g. worm-eating warbler), canopy (e.g. scarlet tanager), ground (e.g. American woodcock), and bark foragers (e.g. common flicker) (Table 8).

W-8, an ungrazed plot, had 31 nesting species, a mean density of 2.6 territories per ha, and 8 species observed only (Table 6). It provided nesting for all strategies but one; the numbers of species in each group were well distributed. The most abundant were the canopy nesters (e.g. summer tanager) and primary cavity excavators (e.g. red-bellied woodpecker) (Table 7). All foraging guilds but one were represented;

Findings and Analysis (cont'd):

the primary ones were the canopy (e.g. black and white warbler), shrub (e.g. Kentucky warbler), and bark foragers (e.g. pileated woodpecker) (Table 8).

B-1, the food plot, had 8 nesting species, a mean density of 5.3 territories per ha, and 11 species observed only (Table 6). It provided nesting primarily for herbaceous (e.g. red-winged blackbird) and low shrub nesters (e.g. cardinal) (Table 7). It was used primarily by canopy (e.g. northern parula), and shrub foragers (e.g. Indigo bunting) (Table 8).

B-2, the clear cut, had 12 nesting species, a mean density of 2.3 territories per ha, and 15 species observed only (Table 6). It provided nesting primarily for low shrub (e.g. gray catbird), canopy (e.g. rose-breasted grosbeak), and midstory shrub nesters (e.g. least flycatcher) (Table 7). It was used by all foraging guilds but one; primarily canopy (e.g. summer tanager), shrub (e.g. brown thrasher), and flycatching foragers (e.g. eastern wood pewee) (Table 8).

B-3, the girdled plot, had 21 nesting species, a mean density of 5.6 territories per ha, and 11 species observed only (Table 6). It provided nesting primarily for low shrub (e.g. rufous-sided towhee), canopy (e.g. eastern wood pewee), and secondary cavity users (e.g. eastern bluebird) (Table 7). It was used by all but one foraging guild; the most abundant were the canopy (e.g. blue jay), bark (e.g. hairy woodpecker), ground (e.g. turkey), shrub (e.g. Indigo bunting), and flycatching foragers (e.g. great crested flycatcher) (Table 8).

B-4, an untreated plot, had 16 nesting species, a mean density of 4.9 territories per ha, and 9 species observed only (Table 6). It provided nesting primarily for canopy nesters (e.g. red-eyed vireo), secondary cavity users (e.g. black-capped chickadee), and low shrub nesters (e.g. gray catbird) (Table 7). It was used primarily by canopy (e.g. yellow-billed cuckoo), shrub (e.g. Kentucky warbler), ground (e.g. ovenbird), and bark foragers (e.g. red-headed woodpecker) (Table 8).

B-5, an untreated plot, had 17 nesting species, a mean density of 7.5 territories per ha, and 8 species observed only (Table 6). It provided nesting primarily for canopy (e.g. summer tanager), and low shrub nesters (e.g. cardinal), and secondary cavity users (e.g. tufted titmouse) (Table 7). It was used primarily by canopy (e.g. rose-breasted grosbeak), shrub (e.g. worm-eating warbler), bark (e.g. white-breasted nuthatch), and flycatching foragers (e.g. whip-poor-will) (Table 8).

The woodland plots provided habitat for a wide variety of birds, but for the most part were occupied by a different set of species than occurred on the open study plots. The addition of a canopy layer has a profound effect. An additional stratum is available for nesting and foraging, and the midstory, shrub and ground strata are different from

Findings and Analysis (cont'd):

those that occur in the open. A few birds occupy the fringes of both types, but most belong primarily to one or the other (open or closed canopy). All nesting and foraging guilds were represented on the forest plots. The primary nesting guilds were the canopy and low shrub nesters, while the primary foraging guilds were the canopy, shrub and ground foragers (Tables 7 and 8). The plots that had the highest number of species were the Whetstone plots. This is due largely to their size relative to the Bennitt plots. W-7 had the highest density of the Whetstone plots because it had a large amount of woods/open edge and thus had both edge and forest interior species. Among the Bennitt plots, B-3, the girdled area, had the highest number of nesting species and second highest density (Table 6). Its partially open canopy and standing dead trees apparently provided more niches than were available on the more open plots (B-1 and B-2), or on the more closed plots (B-4 and B-5).

BREEDING BIRD SURVEY - WHETSTONE

The number of individuals observed in the Whetstone BBS has doubled and the number of species has increased by about 20% since the survey began in 1977 (Table 9). A total of 73 species have been observed on the survey during the period 1977-1980. A number of species have fluctuated in number and thus exhibit no trend, while others have increased or decreased over time. Species that apparently have increased during the period include: eastern kingbird, blue jay, white-breasted nuthatch, gray catbird, American robin, blue-gray gnatcatcher, Bell's vireo, yellow-breasted chat, eastern meadowlark, red-winged blackbird, common grackle, brown-headed cowbird, blue grosbeak, indigo bunting, dickcissel, American goldfinch, rufous-sided towhee, Henslow's sparrow, and field sparrow. Species that apparently have decreased include: red-bellied woodpecker, horned lark, blue-winged warbler, summer tanager, and grass-hopper sparrow. These changes largely are due to an increase in herbaceous and shrubby vegetation since the Department of Conservation bought Whetstone and cattle were removed from the area in 1977. The number of species and individuals probably will not change substantially from now on, but shifts within the species assemblage may occur until the area achieves a level of vegetational stability.

Wintering Season

WINTER BIRD CENSUS

Cropfield -- W-1, which had grass/shrub draws, had 13 species observed and a mean density of 3.5 birds per ha (Table 10). It was used by ground (e.g. song sparrow), herbaceous (e.g. marsh hawk), and shrub foragers (e.g. cedar waxwing) (Table 13).

W-2, which had shrub/tree draws, had 21 species observed and a mean density of 6.2 birds per ha (Table 10). It was used primarily by ground (e.g. horned lark), herbaceous (e.g. white-crowned sparrow), and shrub foragers (e.g. blue jay) (Table 13).

Findings and Analysis (cont'd):

W-3, which had strips of crops and annuals, had 15 species observed and a mean density of 15.4 birds per ha (Table 10). It was used primarily by ground (e.g. lapland longspur), herbaceous (e.g. eastern meadowlark), and shrub foragers (e.g. mockingbird) (Table 13).

P-1, which had multiflora rose hedges, had 27 species observed and a mean density of 45.1 birds per ha (Table 10). It was used primarily by ground (e.g. tree sparrow), herbaceous (e.g. great horned owl), and shrub foragers (e.g. American goldfinch (Table 13).

P-2, the untreated cropfield, had 22 species observed and a mean density of 11.6 birds per ha (Table 10). It was used by ground (e.g. bobwhite), herbaceous (e.g. white-throated sparrow), shrub (e.g. cardinal), and bark foragers (e.g. common flicker) (Table 13).

Cropfields provided important winter habitat for birds and supported more species and higher densities of birds than either grassland or woodland cover types. Because insects are largely unavailable, winter resident birds switch to a seed diet. The crop residue and seeds from natural vegetation associated with cropfields provide high energy food during this critical period. The importance of cover was evident in the results. P-1, with its interspersed rose hedges and crop strips, had the most species and highest density of the cropfield study plots (Table 10). All foraging guilds were represented on cropfield plots but the primary groups were the ground, herbaceous and shrub foragers.

Grassland -- W-4, the ungrazed plot with food strips, had 16 species observed and a mean density of 2.5 birds per hectare (Table 11). It was used primarily by ground (e.g. horned lark), herbaceous (e.g. short-eared owl), and shrub foragers (e.g. blue jay) (Table 13).

W-5, an ungrazed plot, had 12 species observed and a mean density of 1.0 birds per ha (Table 11). It was used primarily by ground (e.g. dark-eyed junco), herbaceous (e.g. marsh hawk), and shrub foragers (e.g. cardinal) (Table 13).

R-1, a grazed plot, had 18 species observed and a mean density of 1.7 birds per ha (Table 11). It was used primarily by ground (e.g. common grackle), herbaceous (e.g. American kestrel), and shrub foragers (e.g. mockingbird) (Table 13).

R-2, a grazed plot, had 10 species observed and a mean density of 0.8 birds per ha (Table 11). It was used primarily by ground (e.g. song sparrow), herbaceous (e.g. eastern meadowlark), and shrub foragers (e.g. blue jay) (Table 13).

The grassland study plots supported fewer birds than the cropfield plots, but were similar to the woodland plots in numbers of species observed and densities. Among the grassland plots, the importance of winter food and cover again was evident. R-1, which had clumps of

Findings and Analysis (cont'd):

blackberries and cedars, had the most species and second highest density of the grassland plots. W-4, which had crop strips, had the highest density and second highest number of species (Table 11). All foraging guilds were represented but the primary groups were the ground, herbaceous and shrub foragers (Table 13).

Woodland -- W-6, the formerly grazed plot, had 18 species observed and a mean density of 1.4 birds per ha (Table 12). It was used by all foraging guilds, but the primary groups were the bark (e.g. brown creeper), shrub (e.g. American goldfinch), and ground foragers (e.g. turkey) (Table 13).

W-7, an ungrazed plot, had 16 species observed and a mean density of 4.2 birds per ha (Table 12). It was used by all foraging guilds; primarily the bark (e.g. downy woodpecker), ground (e.g. bobwhite), shrub (e.g. blue jay), and canopy foragers (e.g. black-capped chickadee) (Table 13).

W-8, an ungrazed plot, had 8 species observed and a mean density of 0.2 birds per ha (Table 12). It was used primarily by bark foragers (e.g. pileated woodpecker) (Table 13).

B-1, the food plot, had 9 species observed and a mean density of 17.5 birds per ha (Table 12). All foraging guilds were represented; the primary groups were the ground (e.g. dark-eyed junco), shrub (e.g. American goldfinch), and canopy foragers (e.g. tufted titmouse) (Table 13).

B-2, the clear cut, had 4 species observed and a mean density of 0.1 birds per ha (Table 12). It was used by shrub (e.g. cardinal), ground (dark-eyed junco), and bark foragers (downy woodpecker) (Table 13).

B-3, the girdled plot, had 4 species observed and a mean density of 0.5 birds per ha (Table 12). It was used by shrub (e.g. American goldfinch) and bark foragers (e.g. red-headed woodpecker) (Table 13).

B-4, an untreated plot, had 5 species observed and a mean density of 1.6 birds per ha (Table 12). It was used by bark (e.g. hairy woodpecker), shrub (American robin), and canopy foragers (black-capped chickadee) (Table 13).

B-5, an untreated plot, had 6 species observed and a mean density of 1.3 birds per ha (Table 12). It was used by shrub (e.g. blue jay), bark (e.g. white-breasted nuthatch), and canopy foragers (black-capped chickadee) (Table 13).

As noted in the breeding season data, the woodland plots supported a different set of birds than the open canopy plots did. The Whetstone plots had more species than the Bennitt plots did due to their larger size. B-1, the food plot, had the highest density of the woodland plots due to the availability of crops left standing (Table 12). All foraging guilds were represented but the main groups were the bark and shrub foragers (Table 13).

Findings and Analysis (cont'd):

CHRISTMAS BIRD COUNT - WHETSTONE

Christmas Bird Counts were conducted on Whetstone in 1978 and 1979. Both yielded about 1,000 individuals of 38 species (Table 14). A total of 47 species have been observed on the count during the period 1978-1979. Two years of data are not enough to examine for trends, but most of the species that winter on Whetstone were detected during the counts and their continuation may yield interesting data as time goes on.

Management Recommendations:

Cropfields should be divided into small units (either strips or blocks) and interspersed with units of annuals, grasses and woody cover (shrubs and trees). Field edges and fencerows should be allowed to develop annual and woody cover as well. This will provide substrates for nesting and foraging and increase the number of birds that can occupy a cropfield throughout the year. Winter bird use should increase as the amount of crop adjacent to cover increases. During the winter bird numbers are higher near good cover. Apparently low, dense cover such as multiflora rose hedge is particularly attractive and beneficial to winter birds. It not only provides excellent roosting and escape cover, but serves as a thermal refuge by diminishing the effects of wind. Where crops are to be left standing for winter food, small grains such as milo and sunflowers should be selected.

The establishment of cover shrubs and trees in grasslands will increase the number of nesting species while food strips will increase winter use. Moderate grazing apparently increases the density of nesting birds without selecting against any species.

Openings in the forest canopy attract old field and edge species and are used as foraging areas by forest interior birds. Planting small openings to grain crops such as milo will provide winter food. Leaving or creating standing dead trees will attract cavity nesters and bark feeders while providing song and foraging perches for other species. Trees left standing in clear cuts will provide song perches, foraging perches and nest sites that otherwise would not be available until the stand regenerated.

Recommendations:

In order to include all of the data that were collected during this study in a single report, it was necessary to present it in a form that has little utility as a management guide. Relevant portions of this study will form the basis for a report containing specific management recommendations for non-game birds.

Data and Reports:

Original data and related reports in this investigation are on file in the Federal Aid Office of the Missouri Department of Conservation, Columbia, Missouri 65201.

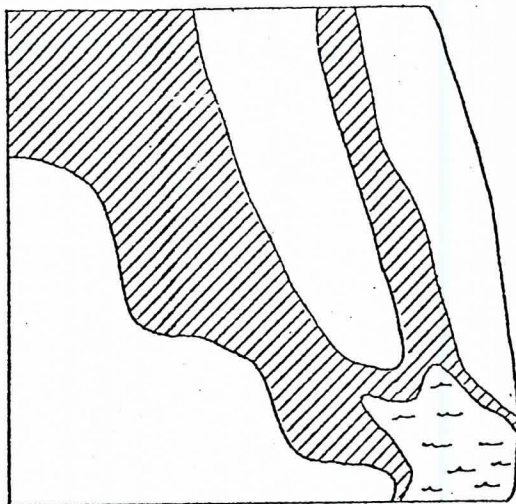
Literature Cited:

James, F.C., and H.H. Shugart, Jr. 1970. A quantitative method of habitat description. Audubon Field Notes 24:727-736.

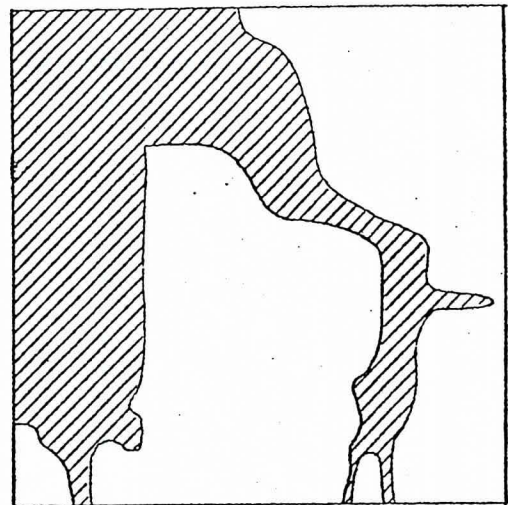
Robbins, C.S. 1970. An international standard for a mapping method in bird census work recommended by the International Bird Census Committee. Audubon Field Notes 24(6):722-726.

_____, and W.T. Van Velzen. 1967. The breeding bird survey, 1966. U.S. Dept. Interior, Bur. Sport Fisheries Wildlife Spec. Rept., Wildl. No. 102.

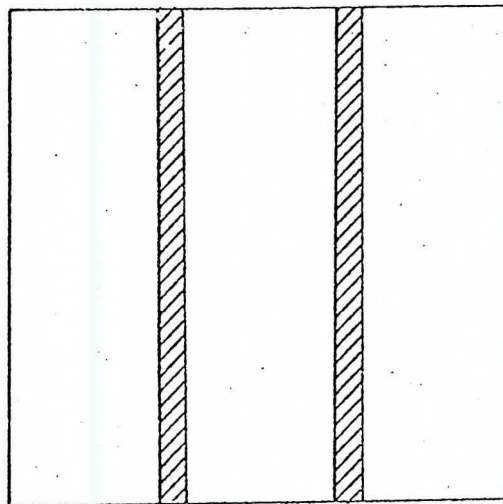
FIGURE 1. Cropfield Study Areas



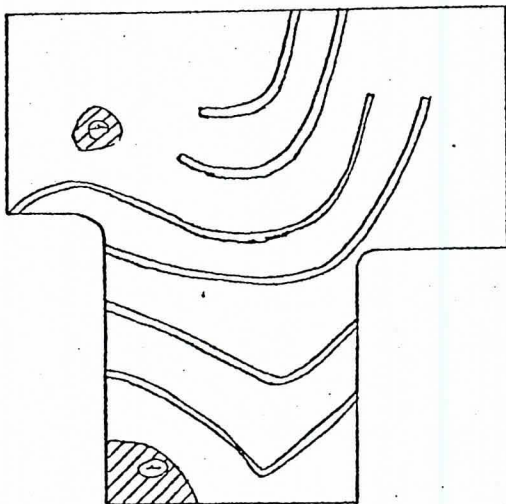
W-1
Crop and Draw (Grass/Shrub)



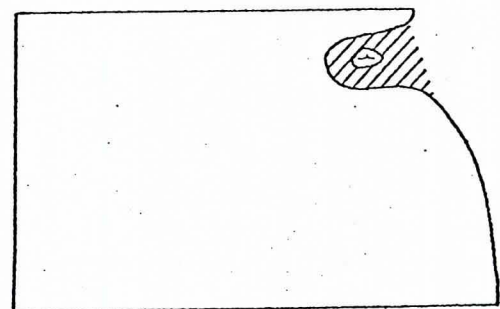
W-2
Crop and Draw (Shrub/Tree)



W-3
Crop and Strips



P-1
Crop and Rose Strips



P-2
Cropfield

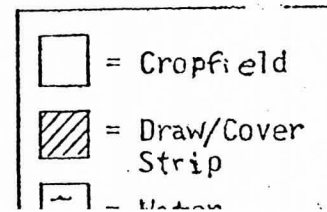
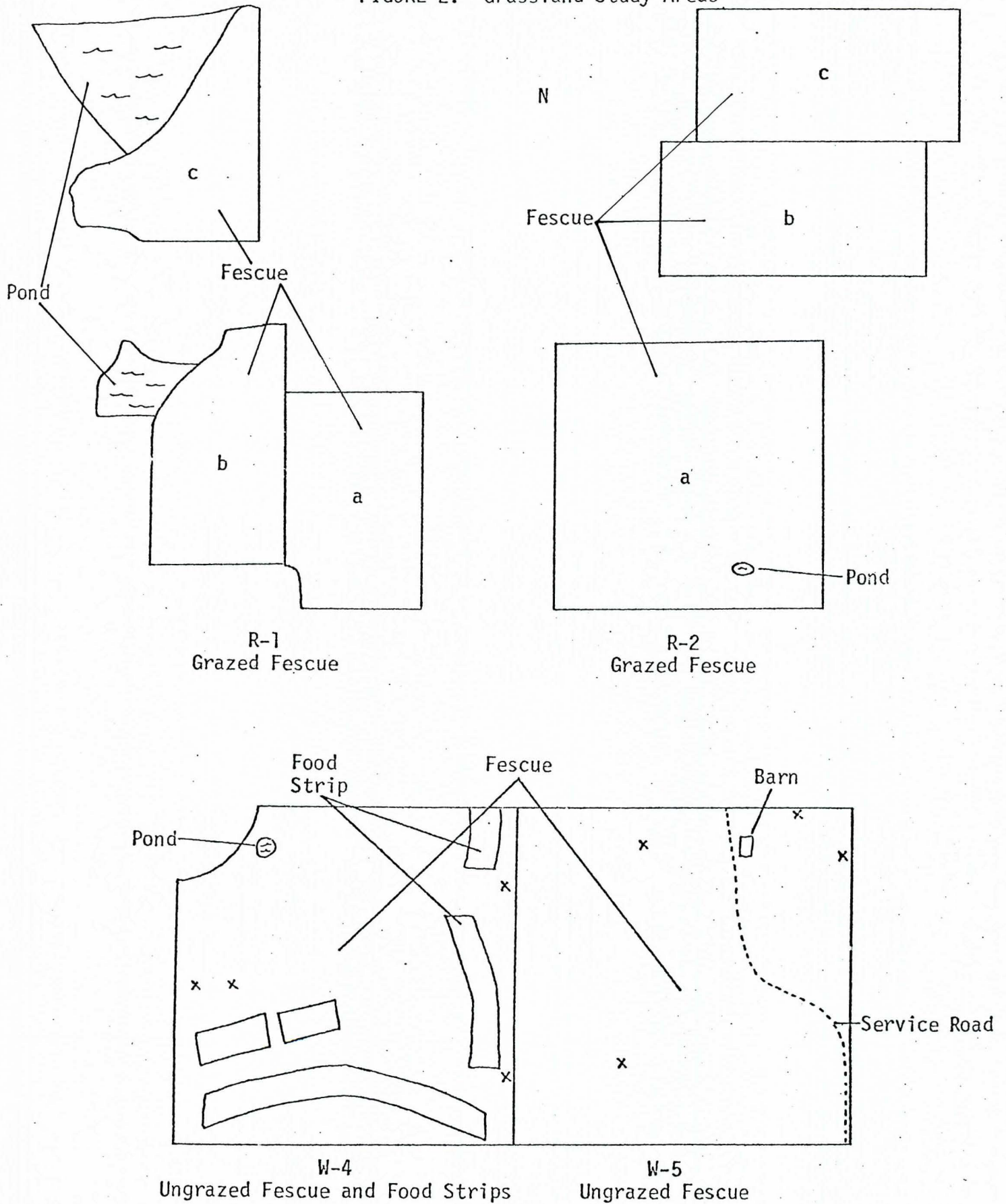


FIGURE 2. Grassland Study Areas



x = Brushpile

FIGURE 3. Woodland Study Areas

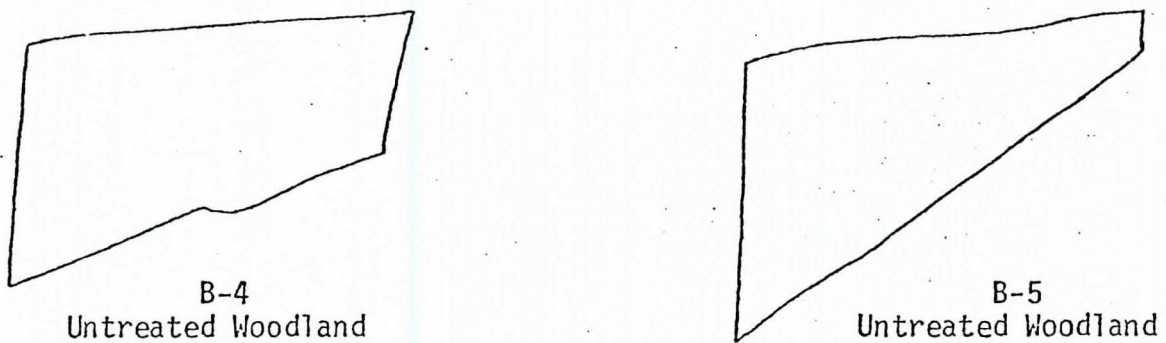
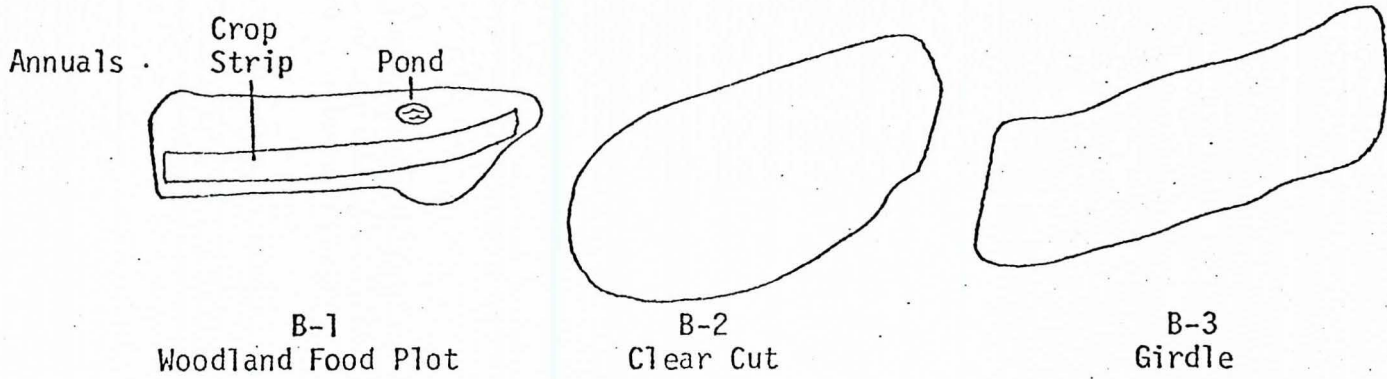
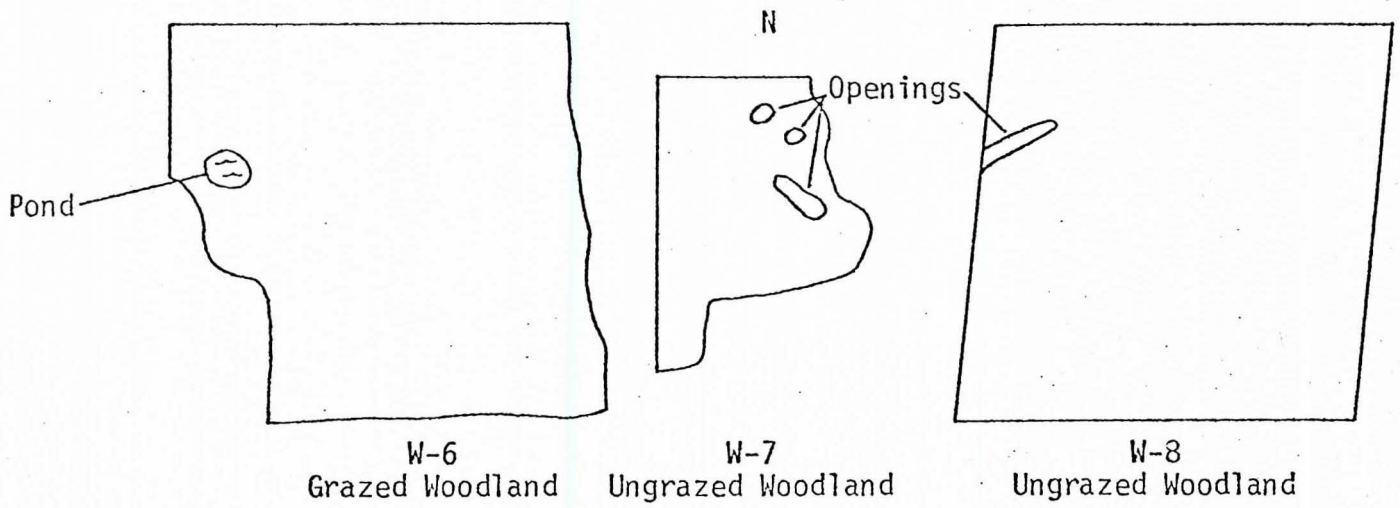


FIGURE 4. Dendrogram showing the results of a cluster analysis of vegetation on the study areas (height of the vertical axis represents dissimilarity between plots).

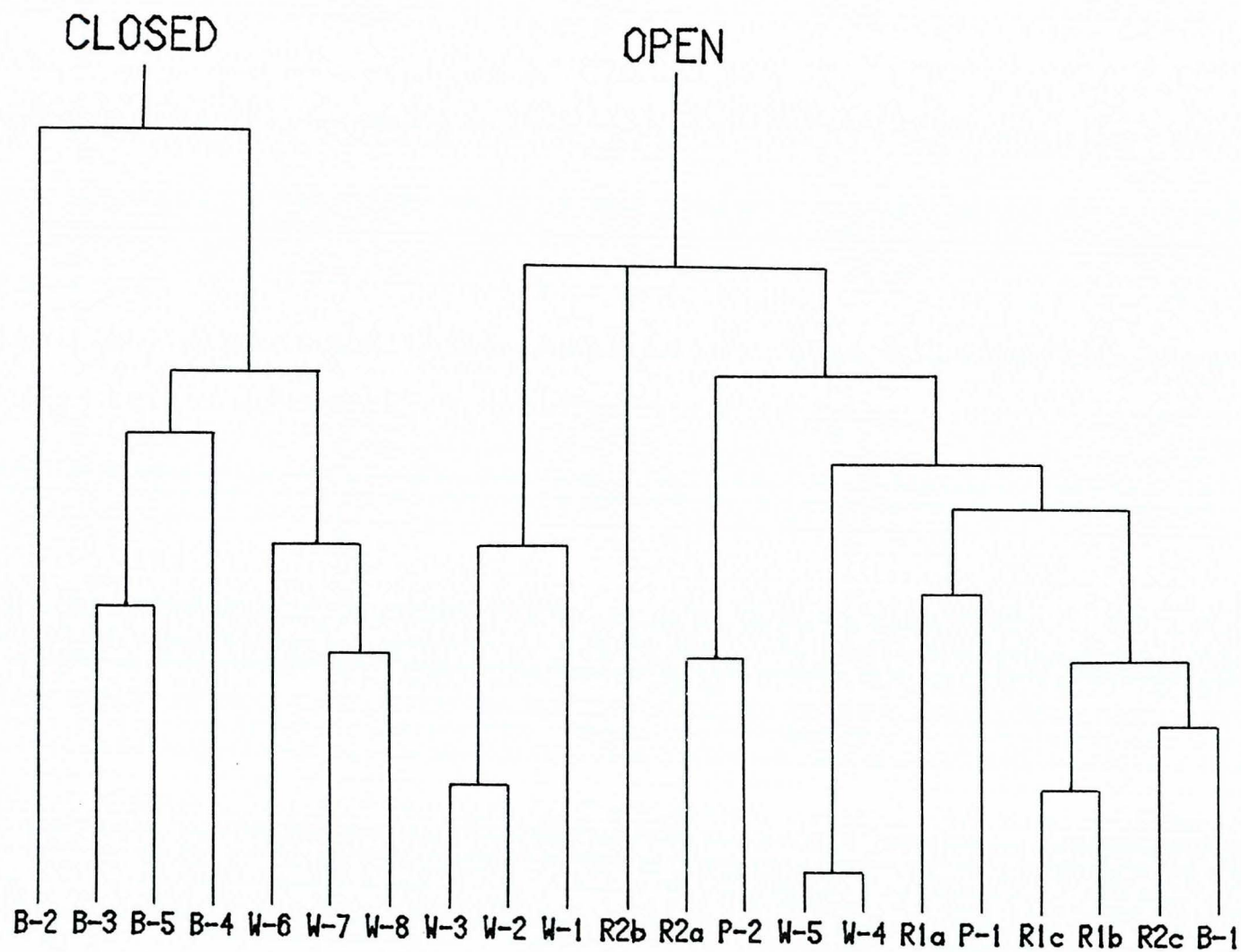


TABLE 1. Vegetational Characteristics of the Cropfield Study Areas

Study Area	Size (ha)	Crops (ha)	Annuals (ha)	Grasses (ha)	Grass/Shrub Draw (ha)	Shrub/Tree Draw (ha)	No. of Ponds	Grass/Shrub Fenceline (m)	Shrub/Tree Fenceline (m)	CANOPY			% Subcanopy Closure	GROUND COVER					LITTER		No. Woody Stems Per Ha
										Mean Height (m)	Maximum Height (m)	% Closure		% Cover	Mean Height (cm)	% Grass	% Forbs	% Woody	% Cover	Mean Depth (cm)	
W-1	16.2	5.3	4.0	--	6.9	--	1	800	--	--	--	--	2	92	55	55	42	3	95	7	815
W-2	16.2	6.5	4.0	--	--	5.7	--	1200	--	--	--	--	2	94	57	14	75	11	89	3	1040
W-3	16.2	7.7	8.1	--	0.4	--	--	1050	160	--	--	--	--	85	50	13	87	--	71	2	--
P-1	8.9	5.3	3.2	--	--	0.4	2	--	1000	0.2	3.7	--	--	94	32	65	32	3	81	3	422
P-2	11.3	8.9	--	2.4	--	--	1	--	1300	--	--	--	--	92	54	24	75	1	95	4	74

TABLE 2. Vegetational Characteristics of the Grassland Study Areas

Study Area	Size (ha)	Crops (ha)	Annuals (ha)	Grasses (ha)	Grass/Shrub Draw (ha)	Shrub/Tree Draw (ha)	No. of Ponds	Grass/Shrub Fenceline (m)	Shrub/Tree Fenceline (m)	CANOPY			% Subcanopy Closure	GROUND COVER					LITTER		No. Woody Stems Per Ha
										Mean Height (m)	Maximum Height (m)	% Closure		% Cover	Mean Height (cm)	% Grass	% Forbs	% Woody	% Cover	Mean Depth (cm)	
W-4	15.0	3.3	--	11.7	--	--	1	400	325	--	--	--	--	100	63	93	6	1	100	11	49
W-5	16.2	0.4	--	15.8	--	--	--	400	325	--	--	--	--	100	65	87	10	3	99	13	99
R-1a	5.7	--	--	5.7	--	--	--	250	450	--	--	--	--	100	18	76	23	1	100	1	86
R-1b	7.7	--	--	7.7	--	--	1	--	575	--	--	--	--	100	43	61	36	1	99	7	136
R-1c	6.5	--	--	6.5	--	--	1	--	700	--	--	--	--	100	46	45	45	10	98	2	148
R-2a	12.1	--	--	12.1	--	--	1	300	900	--	--	--	--	100	58	34	60	6	100	4	716
R-2b	8.5	--	--	8.5	--	--	--	1200	--	--	--	--	--	99	20	88	9	3	98	1	62
R-2c	8.9	--	--	8.9	--	--	--	950	--	--	--	--	--	99	37	59	38	3	99	2	12

TABLE 3. Vegetational Characteristics of the Woodland Study Areas

Study Area	Size (ha)	Crops (ha)	Annuals (ha)	Grasses (ha)	Forest (ha)	No. of Ponds	CANOPY			% Subcanopy Closure	GROUND COVER					LITTER		No. Woody Stems Per ha	BASAL AREA ¹ (ft. ² /ac.)		
							Mean Height (m)	Maximum Height (m)	% Closure		% Cover	Mean Height (cm)	% Grass	% Forbs	% Woody	% Cover	Mean Depth (cm)		Live	Dead	Total
W-6	16.2	--	--	--	16.2	1	18.3	21.3	84	40	67	19	37	51	12	--	--	1107	92	7	99
W-7	6.9	--	--	--	6.9	--	17.1	18.3	81	44	61	19	24	30	46	--	--	951	82	9	91
W-8	16.2	--	--	0.4	15.8	--	18.0	20.7	83	46	57	17	10	26	64	--	--	2581	72	4	76
B-1	1.2	0.4	0.8	--	--	1	1.1	6.7	--	7	97	40	58	34	8	98	9	536	3	--	3
B-2	3.2	--	--	--	3.2	--	7.9	17.7	10	42	92	43	33	37	30	--	--	10460	8	--	8
B-3	2.8	--	--	--	2.8	--	15.3	19.5	19	17	99	58	17	47	36	--	--	4076	30	35	65
B-4	2.4	--	--	--	2.4	--	16.2	17.7	63	47	99	40	53	16	31	--	--	6694	87	4	91
B-5	1.6	--	--	--	1.6	--	18.6	19.8	62	41	88	33	29	37	34	--	--	2816	54	9	63

1. To convert BA to the metric scale (m²/ha), multiply by 0.2296.

TABLE 4. Birds Found During the Breeding Season on the Cropfield Study Areas, 1978-1980

Species	WITH DRAW				WITH STRIPS				UNTREATED	
	Grass/Shrub		Shrub/Tree		Crop/Annuals		Rose		P-2	
	W-1		W-2		W-3		P-1			
	No. Years Observed	Mean No. Terr.	No. Years Observed	Mean No. Terr.	No. Years Observed	Mean No. Terr.	No. Years Observed	Mean No. Terr.	No. Years Observed	Mean No. Terr.
Green Heron	1	0	--	--	--	--	--	--	--	--
Blue-winged Teal	1	0	--	--	--	--	--	--	--	--
Wood Duck	2	0	--	--	--	--	--	--	--	--
Red-tailed Hawk	1	0	--	--	--	--	1	0	1	0
Bobwhite	3	0.3	3	0.7	2	0.3	3	0.3	2	0.3
Killdeer	2	0.3	1	0	1	0	--	--	--	--
Spotted Sandpiper	1	0.3	--	--	--	--	--	--	--	--
Mourning Dove	3	0.7	3	1.7	2	0.3	3	1.0	3	0
Yellow-billed Cuckoo	3	0	3	0.2	2	0	3	1.3	3	1.7
Great Horned Owl	--	--	--	--	--	--	2	0	--	--
Chimney Swift	1	0	--	--	--	--	1	0	1	0
Common Flicker	1	0	--	--	--	--	1	0	--	--
Red-bellied Woodpecker	1	0	--	--	1	0	--	--	1	0
Red-headed Woodpecker	--	--	--	--	2	0	--	--	3	0.7
Eastern Kingbird	3	0.7	2	0	2	0	2	0	2	0.3
Great Crested Flycatcher	--	--	--	--	--	--	1	0.3	--	--
Eastern Phoebe	--	--	--	--	1	0	--	--	--	--
Willow Flycatcher	--	--	3	0.7	--	--	--	--	--	--
Eastern Wood Pewee	--	--	--	--	--	--	1	0	--	--
Horned Lark	3	0.3	2	0.7	3	1.0	--	--	2	0
Tree Swallow	--	--	1	0	--	--	--	--	--	--
Bank Swallow	1	0	--	--	--	--	--	--	--	--
Barn Swallow	1	0	--	--	1	0	2	0	3	0
Purple Martin	1	0	--	--	--	--	--	--	--	--
Blue Jay	1	0	2	0.8	1	0	3	0.7	3	0
Black-capped Chickadee	--	--	1	0	--	--	2	0.3	2	0.3
Mockingbird	--	--	--	--	--	--	1	0	--	--
Gray Catbird	--	--	1	0.7	1	0.2	3	1.7	3	1.0
Brown Thrasher	3	0.7	3	3.0	2	0.7	3	0.7	2	0.3
American Robin	2	0.7	2	0.7	--	--	1	0	--	--
Blue-gray Gnatcatcher	--	--	1	0	--	--	--	--	--	--
Bell's Vireo	1	0.3	3	1.7	1	0	2	0.3	2	0.3

TABLE 4 (continued)

Red-eyed Vireo	--	--	1	0	--	--	--	--	--	--
Yellow Warbler	--	--	3	1.0	--	--	--	--	--	--
Common Yellowthroat	3	2.7	3	3.7	3	1.7	3	0.7	2	0
Yellow-breasted Chat	--	--	3	0.7	--	--	3	1.0	3	0.3
House Sparrow	2	0	--	--	--	--	--	--	--	--
Eastern Meadowlark	3	4.3	3	2.8	3	1.5	2	0.3	2	1.3
Red-winged Blackbird	3	12.7	3	9.2	3	5.5	3	3.7	3	2.7
Orchard Oriole	--	--	2	0.7	--	--	2	0	--	--
Northern Oriole	1	0	1	0	--	--	1	0	--	--
Common Grackle	2	1.0	3	2.0	1	0	1	0	--	--
Brown-headed Cowbird	3	0	3	0	2	0	3	0	3	0
Cardinal	1	0.5	3	0.7	2	0	3	4.7	3	2.7
Rose-breasted Grosbeak	--	--	2	0	--	--	1	0	1	0
Blue Grosbeak	2	0.7	3	1.2	3	0.5	1	0	3	0.7
Indigo Bunting	2	0.7	3	3.2	3	1.5	3	4.3	3	2.3
Dickcissel	3	8.5	3	8.2	3	9.7	3	2.3	3	2.3
American Goldfinch	3	0.7	3	1.0	--	--	3	0.3	3	0
Rufous-sided Towhee	--	--	--	--	--	--	3	1.0	1	0
Grasshopper Sparrow	3	4.1	3	4.5	3	6.2	1	0	2	1.3
Lark Sparrow	--	--	1	0	--	--	--	--	1	0
Field Sparrow	3	0.7	3	3.0	3	1.3	3	4.3	3	0.3
No. Nesting Species	20		24		13		19		17	
No. Species Observed Only	15		10		12		16		13	
Total Species	35		34		25		35		30	
Mean No. Territories	40.8		51.7		30.0		28.7		18.7	
Mean No. Territories/HA	2.5		3.1		1.9		3.2		2.3	

TABLE 5. Birds Found During the Breeding Season on the Grassland Study Areas, 1978-1980

Species	UNGRAZED				GRAZED			
	W/Food Strips		Untreated		R-1		R-2	
	W-4		W-5					
	No. Years Observed	Mean No. Terr.	No. Years Observed	Mean No. Terr.	No. Years Observed	Mean No. Terr.	No. Years Observed	Mean No. Terr.
Wood Duck	--	--	--	--	1	0	--	--
Red-tailed Hawk	--	--	--	--	2	0	1	0
American Kestrel	--	--	--	--	--	--	2	0.3
Bobwhite	3	0.3	2	0	3	1.0	3	1.0
Killdeer	--	--	1	0	1	0	--	--
Rock Dove	--	--	--	--	1	0	--	--
Mourning Dove	3	1.0	3	0.3	3	0.3	2	0.3
Yellow-billed Cuckoo	1	0.3	--	--	2	0	1	0
Chimney Swift	--	--	1	0	1	0	1	0
Common Flicker	1	0	2	0	2	0	--	--
Red-bellied Woodpecker	1	0	1	0	1	0	1	0
Red-headed Woodpecker	1	0	2	0.3	3	0.3	2	0
Hairy Woodpecker	1	0	--	--	--	--	1	0.3
Downy Woodpecker	--	--	--	--	1	0	1	0
Eastern Kingbird	3	1.3	3	0.7	3	0	3	0.3
Great Crested Flycatcher	2	0.3	1	0	2	0	2	0.3
Eastern Wood Pewee	1	0.3	--	--	1	0	--	--
Horned Lark	3	0.3	--	--	--	--	1	0
Rough-winged Swallow	1	0	1	0	1	0	1	0
Barn Swallow	2	0	2	0	1	0	1	0
Purple Martin	1	0	--	--	1	0	--	--
Blue Jay	1	0	2	0	2	0	3	0
Common Crow	1	0	--	--	2	0	1	0
Black-capped Chickadee	1	0	1	0	1	0	1	0
White-breasted Nuthatch	1	0	--	--	1	0	--	--
House Wren	2	0	--	--	3	0.5	--	--
Bewick's Wren	--	--	--	--	1	0.3	--	--
Mockingbird	--	--	--	--	1	0	--	--
Gray Catbird	1	0	1	0.3	3	1.0	--	--
Brown Thrasher	3	0.7	3	0.8	3	1.3	3	0.3
American Robin	3	0.3	1	0	2	0	1	0
Eastern Bluebird	--	--	1	0	1	0	--	--
Starling	--	--	--	--	3	0.3	1	0.3
White-eyed Vireo	--	--	--	--	1	0	--	--
Bell's Vireo	--	--	--	--	1	0.3	--	--
Yellow-throated Vireo	--	--	1	0	--	--	--	--
Common Yellowthroat	2	1.0	3	2.3	3	5.3	3	4.0
Yellow-breasted Chat	1	0.3	--	--	3	1.7	1	0.3
House Sparrow	1	0	1	0	1	0	--	--
Eastern Meadowlark	3	3.7	3	3.3	3	8.3	3	13.7
Red-winged Blackbird	3	5.7	3	4.3	3	9.7	3	29.3
Orchard Oriole	1	0.3	2	0	2	0.7	1	0
Northern Oriole	1	0.3	--	--	2	0.3	1	0
Common Grackle	3	0	2	0	3	0.3	2	0
Brown-headed Cowbird	2	0	2	0	3	0	1	0
Cardinal	2	0.7	2	0	3	3.3	3	0.3
Rose-breasted Grosbeak	--	--	1	0	--	--	1	0
Blue Grosbeak	2	0.3	2	1.0	3	1.0	2	0.7
Indigo Bunting	2	0.3	2	0.7	3	2.0	2	0.8
Dickcissel	3	3.7	3	4.5	3	9.3	3	23.3
American Goldfinch	2	0.3	2	0.3	3	0.7	1	0.3
Rufous-sided Towhee	1	0	1	0	1	0.7	1	0
Grasshopper Sparrow	3	4.0	3	1.3	3	7.5	3	11.8
Henslow's Sparrow	3	3.7	3	5.0	2	0.7	3	6.0
Chipping Sparrow	1	0	--	--	--	--	--	--
Field Sparrow	3	1.0	3	2.3	3	5.2	3	4.1
No. Nesting Species	23		15		25		20	
No. Species Observed Only	18		20		25		19	
Total Species	41		35		50		39	
Mean No. Territories	30.3		27.7		62.2		102.3	
Mean No. Territories/HA	2.0		1.7		3.1		3.5	

TABLE 6. Birds Found During the Breeding Season on the Woodland Study Areas, 1978-1980

Species	FORMERLY GRAZED		UNGRAZED				FOOD PLOT		CLEAR CUT		GIRDLED		UNTREATED			
	W-6		W-7		W-8		B-1		B-2		B-3		B-4		B-5	
	No. Years Observed	Mean No. Terr.	No. Years Observed	Mean No. Terr.	No. Years Observed	Mean No. Terr.	No. Years Observed	Mean No. Terr.	No. Years Observed	Mean No. Terr.	No. Years Observed	Mean No. Terr.	No. Years Observed	Mean No. Terr.	No. Years Observed	Mean No. Terr.
Wood Duck	1	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Red-tailed Hawk	2	0	2	0	--	--	2	0	--	--	2	0	--	--	--	--
Broad-winged Hawk	--	--	--	--	--	--	--	--	1	0	--	--	--	--	--	--
Bobwhite	3	0.3	3	0	--	--	--	--	--	--	--	--	--	--	--	--
Turkey	--	--	--	--	--	--	--	--	--	--	1	0	1	0	--	--
American Woodcock	1	0	2	0	--	--	--	--	--	--	--	--	--	--	--	--
Mourning Dove	3	0.7	3	1.3	1	0	--	--	1	0.3	--	--	--	--	--	--
Yellow-billed Cuckoo	3	1.7	3	3.7	3	2.7	1	0	1	0	1	0	1	0	2	0
Black-billed Cuckoo	1	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chuck-will's-widow	--	--	2	0	--	--	--	--	--	--	--	--	--	--	--	--
Whip-poor-will	1	0.3	--	--	2	0.3	--	--	--	--	--	--	--	--	1	0
Common Nighthawk	1	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ruby-throated Hummingbird	--	--	--	--	1	0	--	--	--	--	--	--	--	--	--	--
Common Flicker	1	0.5	3	0.7	1	0.3	--	--	--	--	1	0	--	--	2	0
Pileated Woodpecker	3	0.7	3	0.3	3	0.8	--	--	--	--	--	--	--	--	--	--
Red-bellied Woodpecker	3	3.0	2	0	2	1.0	--	--	1	0	3	1.0	3	0.3	3	0.7
Red-headed Woodpecker	3	1.3	3	0.3	2	0.7	--	--	--	--	2	0.7	1	0.3	1	0.3
Hairy Woodpecker	2	0	2	0.7	2	0.7	--	--	--	--	2	0	2	0	1	0
Downy Woodpecker	3	0.7	3	0.3	3	1.0	--	--	--	--	2	0	--	--	--	--
Eastern Kingbird	3	1.0	2	0.7	--	--	--	--	--	--	--	--	--	--	--	--
Great Crested Flycatcher	3	3.2	3	2.0	2	1.0	--	--	1	0	3	1.0	2	0.7	3	2.0
Eastern Phoebe	1	1.0	--	--	--	--	--	--	1	0	1	0	--	--	--	--
Acadian Flycatcher	--	--	--	--	1	0.3	--	--	--	--	--	--	--	--	--	--
Least Flycatcher	--	--	2	0.7	--	--	--	--	1	0.3	1	0.3	--	--	1	0
Eastern Wood Pewee	2	2.3	3	3.7	3	2.7	--	--	2	0.3	3	1.0	3	0.7	2	1.0
Blue Jay	3	1.7	3	3.3	3	3.3	1	0	2	0	2	0	3	0.3	3	0.7
Common Crow	--	--	2	0	--	--	--	--	--	--	1	0	--	--	--	--
Black-capped Chickadee	2	0	3	1.0	2	0.3	1	0	1	0	3	0.7	2	0.3	2	0.3
Tufted Titmouse	2	0.3	3	1.3	3	1.3	--	--	1	0	1	0.3	2	0.3	3	0.3
White-breasted Nuthatch	3	0.7	3	0	2	3.2	--	--	1	0	2	0.7	3	0.7	1	0.3
House Wren	1	0.3	3	1.3	--	--	--	--	--	--	--	--	--	--	--	--
Mockingbird	--	--	1	0	--	--	--	--	--	--	--	--	--	--	--	--
Gray Catbird	3	0.7	3	2.0	1	0	2	0.7	3	1.0	3	1.7	3	1.3	3	1.0
Brown Thrasher	3	1.0	3	0.7	1	0.3	1	0	2	0	2	0.3	1	0	--	--

TABLE 6 (continued)

American Robin	3	1.0	2	0.7	--	--	--	--	--	--	--	--	--	--
Wood Thrush	3	0.7	2	0	2	1.7	--	--	--	--	1	0	--	--
Eastern Bluebird	3	0.7	2	0	--	--	--	--	1	0.3	--	--	--	--
Blue-gray Gnatcatcher	2	0.3	2	0	2	0.3	2	0	2	0.3	1	0.3	--	--
Yellow-throated Vireo	--	--	1	0	1	0	--	--	--	--	1	0.3	--	--
Red-eyed Vireo	3	3.0	1	0	3	3.3	2	0	3	0.3	3	1.0	2	1.3
Black-and-white Warbler	--	--	--	--	2	0.3	--	--	--	--	--	--	--	--
Worm-eating Warbler	--	--	1	0.3	2	1.3	--	--	--	--	1	0.3	1	0.3
Blue-winged Warbler	1	0	--	--	--	--	1	0	--	--	--	--	--	--
Northern Parula	3	0.3	--	--	--	--	2	1.0	--	--	--	--	--	--
Ovenbird	2	0.7	1	0.3	3	5.3	--	--	--	--	--	--	3	1.3
Louisiana Waterthrush	3	0.3	--	--	--	--	--	--	--	--	--	--	--	--
Kentucky Warbler	2	0.8	--	--	2	0.7	1	0	3	0.7	3	0.7	2	0
Common Yellowthroat	2	0.7	3	3.3	1	0.3	1	0.3	--	--	--	--	--	--
Yellow-breasted Chat	--	--	3	1.3	--	--	--	--	--	--	--	--	--	--
House Sparrow	--	--	2	0	--	--	--	--	--	--	--	--	--	--
Eastern Meadowlark	1	0	--	--	--	--	--	--	--	--	--	--	--	--
Red-winged Blackbird	3	2.3	3	1.3	1	0	2	0.7	1	0	--	--	--	--
Orchard Oriole	2	0.7	--	--	--	--	--	--	--	--	--	--	--	--
Northern Oriole	3	1.3	2	1.3	1	0	--	--	1	0	--	--	1	0
Common Grackle	2	0.7	--	--	--	--	--	--	--	--	1	0	--	--
Brown-headed Cowbird	3	0	3	0	3	0	3	0	3	0	3	0	3	0
Scarlet Tanager	3	1.0	2	0	3	2.7	--	--	1	0	--	--	--	1
Summer Tanager	3	1.0	1	0	3	2.2	--	--	1	0.3	2	0.3	3	0.3
Cardinal	3	2.0	3	2.0	3	3.3	2	0.3	2	0.7	1	1.0	3	0.3
Rose-breasted Grosbeak	3	2.3	3	2.3	1	0.3	1	0	3	0.7	2	1.3	2	1.0
Blue Grosbeak	--	--	3	1.0	1	0	--	--	--	--	--	--	--	--
Indigo Bunting	3	1.3	3	4.0	2	0.3	3	1.0	3	1.0	2	1.7	1	0
American Goldfinch	2	0	2	0.7	--	--	--	--	--	--	--	--	--	--
Rufous-sided Towhee	1	1.0	3	2.0	3	2.0	3	0.7	3	1.3	2	1.3	3	2.0
Field Sparrow	2	0.3	3	3.3	2	0.7	2	0.7	1	0	1	0.3	--	--
No. Nesting Species	40		31		31		8		12		21		16	
No. Species Observed Only	11		17		8		11		15		11		9	
Total Species	51		48		39		19		27		32		25	
Mean No. Territories	43.8		48.0		42.8		6.3		7.3		12.3		11.7	
Mean No. Territories/HA	2.7		7.0		2.6		5.3		2.3		5.6		4.9	

TABLE 7. Nesting Strategies of Species Found in the Breeding Bird Census, 1978-1980

	CROPFIELD					GRASSLAND				WOODLAND							
	w/Draw		w/Strips		Untreated	Ungrazed											
	Grass/Shrub	Shrub/Tree	Crop/Annuals	Rose		w/Food Strips	Untreated										
Nesting Strategy	W-1	W-2	W-3	P-1	P-2	W-4	W-5	R-1	R-2	Formerly Grazed	Ungrazed	Ungrazed	Food Plot	Clear Cut	Girdled	Untreated	Untreated
Ground	6	4	4	2	3	4	2	3	3	4	2	4	-	-	-	2	2
Herbaceous	5	5	5	5	4	6	6	6	6	4	4	3	4	1	2	-	-
Low Shrub	7	10	3	7	6	6	4	9	5	7	8	4	3	4	5	3	4
Midstory Shrub	2	4	1	2	2	4	2	2	2	6	4	4	-	3	2	-	-
Canopy	-	1	-	1	-	2	-	1	-	8	4	6	1	4	5	5	5
Primary Cavity Excavator	-	-	-	-	1	-	1	1	1	5	5	6	-	-	2	2	2
Secondary Cavity User	-	-	-	2	1	1	-	3	3	5	4	4	-	-	5	4	4
Structures	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-
TOTALS	20	24	13	19	17	23	15	25	20	40	31	31	8	12	21	16	17

TABLE 8. Foraging Patterns of Species Found in the Breeding Bird Census, 1978-1980

Foraging Pattern	CROPFIELD					GRASSLAND				WOODLAND							
	w/Draw		w/Strips		Untreated	Ungrazed		Grazed Grazed		Formerly Grazed	Ungrazed	Ungrazed	Food Plot	Clear Cut	Girdled	Untreated	Untreated
	Grass/Shrub	Shrub/Tree	Crop/Annuals	Rose		w/Food Strips	Untreated										
W-1	W-2	W-3	P-1	P-2	W-4	W-5	R-1	R-2	W-6	W-7	W-8	B-1	B-2	B-3	B-4	B-5	
Ground	11	10	8	8	8	13	11	14	12	9	9	4	2	3	5	4	3
Herbaceous	4	3	3	5	4	3	3	4	4	4	3	2	3	3	2	-	-
Shrub	7	9	7	10	9	9	7	13	7	10	12	10	6	5	5	7	5
Canopy	3	9	2	6	4	5	5	5	6	13	11	12	8	10	9	8	8
Bark	2	-	2	1	2	5	3	5	4	7	7	7	-	2	6	4	5
Flycatching	5	3	3	5	3	6	6	8	6	7	6	4	-	4	5	2	4
Water	3	-	-	-	-	-	-	1	-	1	-	-	-	-	-	-	-
TOTALS	35	34	25	35	30	41	35	50	39	51	48	39	19	27	32	25	25

TABLE 9. Results of the Breeding Bird Survey on the Whetstone Creek Wildlife Area, 1977-1980

	1977	1978	1979	1980		1977	1978	1979	1980
Green Heron	0	0	0	1	Golden-winged Warbler	1	0	2	0
Wood Duck	0	0	0	2	Blue-winged Warbler	4	0	2	1
Turkey Vulture	1	0	0	0	Northern Parula	1	2	0	0
Red-tailed Hawk	1	0	3	2	Ovenbird	0	0	1	1
Bobwhite	19	23	29	21	Common Yellowthroat	13	8	13	19
Turkey	0	1	0	0	Yellow-breasted Chat	3	2	11	14
Killdeer	1	1	1	1	Kentucky Warbler	0	0	2	0
Mourning Dove	20	67	20	36	House Sparrow	1	6	12	1
Yellow-billed Cuckoo	15	22	21	7	Eastern Meadowlark	18	29	70	57
Great Horned Owl	0	1	0	0	Western Meadowlark	0	0	0	1
Barred Owl	0	0	0	1	Red-winged Blackbird	27	55	182	118
Chimney Swift	0	5	2	4	Orchard Oriole	2	2	1	0
Common Flicker	1	5	3	5	Northern Oriole	2	0	3	3
Pileated Woodpecker	3	0	1	1	Common Grackle	6	9	22	23
Red-bellied Woodpecker	11	10	8	5	Brown-headed Cowbird	7	22	60	17
Red-headed Woodpecker	4	1	12	7	Scarlet Tanager	0	0	2	1
Hairy Woodpecker	0	0	4	1	Summer Tanager	5	3	1	0
Downy Woodpecker	0	1	1	2	Cardinal	12	10	11	12
Eastern Kingbird	3	3	10	7	Rose-breasted Grosbeak	1	6	10	3
Great Crested Flycatcher	4	5	5	8	Blue Grosbeak	1	3	21	12
Eastern Phoebe	0	0	0	1	Indigo Bunting	7	12	18	18
Eastern Wood Pewee	4	6	5	6	Dickcissel	22	21	74	44
Horned Lark	6	0	1	3	American Goldfinch	1	1	7	5
Rough-winged Swallow	0	0	1	0	Rufous-sided Towhee	3	2	10	8
Barn Swallow	2	0	5	0	Grasshopper Sparrow	26	9	14	9
Purple Martin	0	0	4	0	Henslow's Sparrow	0	5	19	7
Blue Jay	6	6	9	13	Field Sparrow	10	20	29	40
Common Crow	8	4	7	10					
Black-capped Chickadee	0	0	1	3					
Carolina Chickadee	0	0	0	3	NO. SPECIES	48	45	58	57
Tufted Titmouse	8	4	8	4					
White-breasted Nuthatch	1	1	7	4	NO. INDIVIDUALS	316	415	808	616
House Wren	0	3	2	2					
Mockingbird	4	2	0	0					
Gray Catbird	2	2	4	5					
Brown Thrasher	9	10	21	12					
American Robin	4	2	6	13					
Wood Thrush	1	0	1	0					
Blue-gray Gnatcatcher	0	1	5	4					
Loggerhead Shrike	1	0	0	0					
Starling	0	0	0	1					
White-eyed Vireo	0	0	0	1					
Bell's Vireo	0	0	2	4					
Yellow-throated Vireo	0	0	1	0					
Red-eyed Vireo	4	2	0	0					
Warbling Vireo	1	0	2	2					

TABLE 10. Birds Found During the Wintering Season on the Cropfield Study Areas, 1979-1981

Species	WITH DRAW				WITH STRIPS				UNTREATED	
	Grass/Shrub		Shrub/Tree		Crop/Annuals		Rose		P-2	
	W-1		W-2		W-3		P-1			
	No.		No.		No.		No.			
	Years		Years		Years		Years			
Observed	Mean	Observed	Mean	Observed	Mean	Observed	Mean	Observed	Mean	
Marsh Hawk	1	0.1	3	0.7	3	0.6	1	0.1	2	0.4
American Kestrel	--	--	--	--	--	--	1	0.1	1	0.2
Bobwhite	--	--	--	--	--	--	1	0.5	2	2.8
Great Horned Owl	--	--	--	--	--	--	1	0.1	--	--
Short-eared Owl	--	--	1	0.3	--	--	--	--	--	--
Common Flicker	--	--	--	--	--	--	2	0.4	2	1.0
Red-bellied Woodpecker	--	--	1	0.2	--	--	1	0.2	2	0.3
Red-headed Woodpecker	--	--	--	--	--	--	--	--	2	0.3
Hairy Woodpecker	--	--	1	0.1	--	--	--	--	--	--
Downy Woodpecker	--	--	--	--	1	0.3	2	0.6	1	0.2
Horned Lark	1	0.3	2	9.2	3	20.8	--	--	1	0.2
Blue Jay	1	0.1	2	0.6	--	--	3	3.9	3	3.5
Common Crow	--	--	1	0.3	--	--	--	--	--	--
Black-capped Chickadee	--	--	--	--	--	--	3	1.6	--	--
Mockingbird	--	--	1	1.0	1	0.1	3	1.1	--	--
American Robin	--	--	--	--	1	0.2	2	0.8	2	1.0
Cedar Waxwing	1	0.9	--	--	--	--	--	--	--	--
Loggerhead Shrike	1	0.3	1	0.2	--	--	--	--	--	--
Starling	--	--	1	0.1	--	--	1	5.6	--	--
House Sparrow	1	13.3	1	13.2	1	15.8	3	117.8	3	1.7
Eastern Meadowlark	3	1.1	3	1.7	1	2.1	3	0.3	1	2.2
Red-winged Blackbird	1	0.3	--	--	1	0.1	2	17.3	1	0.8
Common Grackle	--	--	--	--	--	--	2	2.4	--	--
Blackbird spp.	--	--	--	--	--	83.3	--	--	--	--
Cardinal	1	1.6	3	2.4	2	1.3	3	12.6	3	6.2
Purple Finch	--	--	3	7.2	--	--	2	1.0	--	--
American Goldfinch	1	6.6	1	0.8	--	--	2	4.1	1	4.8
Rufous-sided Towhee	--	--	--	--	--	--	1	0.1	--	--
Dark-eyed Junco	2	13.8	3	7.8	1	25.9	3	7.7	2	12.1
Tree Sparrow	3	15.5	3	30.6	3	68.0	3	85.6	3	26.7

TABLE 10 (continued)

Harris' Sparrow	--	--	1	0.3	--	--	2	0.5	1	0.2
White-crowned Sparrow	--	--	3	15.8	2	11.6	3	123.6	3	14.7
White-throated Sparrow	--	--	--	--	--	--	1	0.3	1	0.2
Fox Sparrow	--	--	--	--	--	--	--	--	1	0.2
Swamp Sparrow	--	--	2	7.6	1	1.2	2	2.7	--	--
Song Sparrow	2	2.7	3	3.6	1	0.3	3	11.1	3	0.8
Lapland Longspur	--	--	--	--	1	17.8	--	--	--	--
No. Species Observed	13		21		15		27		22	
Mean No. Birds	55.6		101.1		246.0		401.6		80.2	
Mean No. Birds/HA	3.5		6.2		15.4		45.1		11.6	

TABLE 11. Birds Found During the Wintering Season on the Grassland Study Areas, 1979-1981

Species	UNGRAZED				GRAZED			
	W/Food Strips		Untreated		R-1		R-2	
	W-4		W-5					
	No. Years Observed	Mean	No. Years Observed	Mean	No. Years Observed	Mean	No. Years Observed	Mean
Marsh Hawk	2	0.2	2	0.6	1	0.3	2	0.4
American Kestrel	--	--	--	--	2	0.7	1	0.5
Bobwhite	1	0.3	--	--	1	1.7	--	--
Short-eared Owl	1	0.1	--	--	--	--	--	--
Downy Woodpecker	1	0.1	1	0.1	1	0.4	1	0.2
Horned Lark	2	1.1	2	0.7	--	--	--	--
Blue Jay	1	0.6	--	--	2	3.3	1	0.2
Common Crow	--	--	--	--	1	0.5	--	--
Black-capped Chickadee	--	--	2	1.4	--	--	--	--
Mockingbird	1	0.1	1	0.2	1	0.2	--	--
American Robin	1	0.3	1	0.7	1	0.5	--	--
Loggerhead Shrike	--	--	1	0.2	--	--	--	--
Yellow-rumped Warbler	--	--	--	--	1	0.2	--	--
House Sparrow	1	0.8	--	--	1	0.2	--	--
Eastern Meadowlark	--	--	1	4.2	1	0.3	2	1.7
Red-winged Blackbird	1	0.1	--	--	--	--	--	--
Common Grackle	--	--	--	--	1	1.4	--	--
Cardinal	3	2.5	1	0.8	2	3.3	2	4.3
Purple Finch	1	0.2	--	--	1	1.0	1	1.7
Cark-eyed Junco	2	22.3	2	2.2	2	10.9	1	5.0
Tree Sparrow	2	4.7	2	2.3	1	8.5	1	11.9
White-crowned Sparrow	1	0.2	--	--	1	0.2	--	--
Song Sparrow	2	4.7	2	3.7	1	0.2	1	0.9
No. Species Observed	16		12		18		10	
Mean No. Birds	39.5		17.1		33.9		25.5	
Mean No. Birds/HA	2.5		1.0		1.7		0.8	

TABLE 12. Birds Found During the Wintering Season on the Woodland Study Areas, 1979-1981

Species	FORMERLY GRAZED		UNGRAZED				FOOD PLOT		CLEAR CUT		GIRDLED		UNTREATED			
	W-6		W-7		W-8		B-1		B-2		B-3		B-4		B-5	
	No. Years Observed	Mean	No. Years Observed	Mean	No. Years Observed	Mean	No. Years Observed	Mean	No. Years Observed	Mean	No. Years Observed	Mean	No. Years Observed	Mean	No. Years Observed	Mean
Red-tailed Hawk	--	--	--	--	--	--	1	0.2	--	--	--	--	--	--	--	--
Bobwhite	--	--	1	4.0	--	--	--	--	--	--	--	--	--	--	--	--
Turkey	1	0.1	--	--	--	--	1	0.5	--	--	--	--	--	--	--	--
Great Horned Owl	1	0.1	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Common Flicker	2	0.3	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Pileated Woodpecker	--	--	1	0.2	1	0.3	--	--	--	--	--	--	--	--	--	--
Red-bellied Woodpecker	3	1.6	2	0.7	1	0.3	--	--	--	--	--	--	--	--	--	--
Red-headed Woodpecker	1	0.8	1	2.3	--	--	--	--	--	--	1	0.7	1	1.7	1	1.0
Hairy Woodpecker	2	2.2	3	0.7	1	0.2	--	--	--	--	--	--	1	0.1	--	--
Downy Woodpecker	3	1.2	2	0.3	2	1.0	1	0.1	1	0.1	1	0.1	--	--	--	--
Blue Jay	3	3.8	3	3.9	2	0.4	1	0.2	1	0.1	--	--	--	--	1	0.3
Black-capped Chickadee	2	0.8	1	1.0	2	0.7	1	0.1	--	--	--	--	1	0.2	1	0.2
Tufted Titmouse	--	--	1	0.2	--	--	2	0.4	--	--	--	--	--	--	--	--
White-breasted Nuthatch	3	3.3	3	1.1	2	0.7	--	--	--	--	--	--	1	0.1	2	0.3
Brown Creeper	1	0.1	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Mockingbird	1	0.3	--	--	--	--	--	--	--	--	--	--	--	--	--	--
American Robin	1	0.3	--	--	1	0.3	--	--	--	--	--	--	1	1.7	--	--
Starling	--	--	1	0.3	--	--	--	--	--	--	--	--	--	--	--	--
Cardinal	2	0.7	3	1.8	--	--	--	--	1	0.1	1	0.3	--	--	1	0.2
Purple Finch	--	--	1	5.0	--	--	--	--	--	--	--	--	--	--	--	--
American Goldfinch	1	0.9	1	0.7	--	--	1	1.0	--	--	1	0.1	--	--	1	0.1
Dark-eyed Junco	3	3.8	2	5.7	--	--	3	18.1	1	0.2	--	--	--	--	--	--
Tree Sparrow	2	1.2	--	--	--	--	2	0.6	--	--	--	--	--	--	--	--
Field Sparrow	--	--	1	1.2	--	--	--	--	--	--	--	--	--	--	--	--
Song Sparrow	2	0.6	--	--	--	--	--	--	--	--	--	--	--	--	--	--
No. Species Observed	18		16		8		9		4		4		5		6	
Mean No. Birds	22.0		29.0		3.7		20.9		0.4		1.2		3.8		2.2	
Mean No. Birds/HA	1.4		4.2		0.2		17.5		0.1		0.5		1.6		1.3	

TABLE 13. Foraging Patterns of Species Found in the Winter Bird Census, 1979-1981

Foraging Pattern	CROPFIELD					GRASSLAND				WOODLAND							
	w/Draw		w/Strips		Untreated	Ungrazed											
	Grass/Shrub	Shrub/Tree	Crop/Annuals	Rose		w/Food Strips	Untreated										
W-1	W-2	W-3	P-1	P-2	W-4	W-5	R-1	R-2	W-6	W-7	W-8	B-1	B-2	B-3	B-4	B-5	
Ground	5	9	7	10	8	6	4	7	3	4	3	-	3	1	-	-	-
Herbaceous	4	5	4	7	6	4	3	4	3	1	1	-	1	-	-	-	-
Shrub	4	4	3	5	4	4	3	4	2	5	3	2	2	2	2	1	3
Canopy	-	1	-	2	-	1	1	2	1	1	3	1	2	-	-	1	1
Bark	-	2	1	3	4	1	1	1	1	7	6	5	1	1	2	3	2
TOTALS	13	21	15	27	22	16	12	18	10	18	16	8	9	4	4	5	6

TABLE 14. Results of the Christmas Bird Count on the Whetstone Creek Wildlife Area, 1978-1979.

	1978	1979		1978	1979
Mallard	3	0	House Sparrow	79	168
Wood Duck	2	0	Eastern Meadowlark	76	42
Sharp-shinned Hawk	1	1	Red-winged Blackbird	2	4
Cooper's Hawk	2	0	Common Grackle	0	5
Red-tailed Hawk	5	5	Brown-headed Cowbird	25	0
Rough-legged Hawk	0	1	Cardinal	44	66
Marsh Hawk	4	0	Purple Finch	3	0
American Kestrel	6	1	American Goldfinch	13	23
Bobwhite	6	0	Dark-eyed Junco	152	206
Turkey	0	3	Tree Sparrow	181	154
Mourning Dove	59	15	Field Sparrow	1	0
Barred Owl	0	1	White-crowned Sparrow	94	15
Belted Kingfisher	2	1	Swamp Sparrow	0	3
Common Flicker	3	6	Song Sparrow	6	5
Pileated Woodpecker	4	6			
Red-bellied Woodpecker	7	13			
Red-headed Woodpecker	1	1			
Yellow-bellied Sapsucker	1	0			
Hairy Woodpecker	0	10			
Downy Woodpecker	12	20			
Horned Lark	3	18			
Blue Jay	45	36			
Common Crow	16	22			
Black-capped Chickadee	11	49	NO. SPECIES	37	38
Tufted Titmouse	18	17			
White-breasted Nuthatch	12	21			
Mockingbird	1	2	NO. INDIVIDUALS	966	1,049
American Robin	0	38			
Eastern Bluebird	0	12			
Golden-crowned Kinglet	0	1			
Cedar Waxwing	0	22			
Loggerhead Shrike	1	1			
Starling	65	35			

APPENDIX I

	FORAGING PATTERN ²				FORAGING PATTERN ²		
	Nest ¹	Breeding			Nest ¹	Breeding	
	Site	Season	Winter		Site	Season	Winter
<u>ANSERIFORMES</u>				<u>Turdidae</u>			
Blue-winged Teal	H	W	-	American Robin	S	G	S
Wood Duck	U	W	-	Wood Thrush	T	S	-
<u>FALCONIFORMES</u>				Eastern Bluebird	U	F	-
Red-tailed Hawk	C	H	H	<u>Sylviidae</u>			
Broad-winged Hawk	C	H	-	Blue-gray Gnatcatcher	T	C	-
Marsh Hawk	H	H	H	<u>Bombycillidae</u>			
American Kestrel	U	F	H	Cedar Waxwing	-	-	S
<u>GALLIFORMES</u>				<u>Laniidae</u>			
Bobwhite	G	G	G	Loggerhead Shrike	T	H	H
Turkey	G	G	G	<u>Sturnidae</u>			
<u>CICONIIFORMES</u>				Starling	U	G	G
Green Heron	C	W	-	<u>Vireonidae</u>			
<u>CHARADRIIFORMES</u>				White-eyed Vireo	S	S	-
Killdeer	G	G	-	Bell's Vireo	S	S	-
American Woodcock	G	G	-	Yellow-throated Vireo	C	C	-
Spotted Sandpiper	G	G	-	Red-eyed Vireo	C	C	-
<u>COLUMBIFORMES</u>				<u>Parulidae</u>			
Rock Dove	B	G	G	Black & White Warbler	G	C	-
Mourning Dove	T	G	G	Worm-eating Warbler	G	S	-
<u>CUCULIFORMES</u>				Blue-winged Warbler	T	C	-
Yellow-billed Cuckoo	T	C	-	Northern Parula	C	C	-
Black-billed Cuckoo	S	S	-	Yellow Warbler	S	C	-
<u>CAPRIMULGIFORMES</u>				Yellow-rumped Warbler	-	-	C
Chuck-will's Widow	G	F	-	Ovenbird	G	G	-
Whip-poor-will	G	F	-	Louisiana Waterthrush	G	G	-
Common Nighthawk	G	F	-	Kentucky Warbler	S	S	-
<u>APODIFORMES</u>				Common Yellowthroat	H	S	-
Chimney Swift	B	F	-	Yellow-breasted Chat	S	S	-
Ruby-throated Hummingbird	T	H	-	<u>Ploceidae</u>			
<u>STRIGIFORMES</u>				House Sparrow	B	G	G
Great Horned Owl	U	H	H	<u>Icteridae</u>			
Short-eared Owl	-	-	H	Eastern Meadowlark	G	H	H
<u>PICIFORMES</u>				Red-winged Blackbird	H	H	H
Common Flicker	X	B	B	Orchard Oriole	T	C	-
Pileated Woodpecker	X	B	B	Northern Oriole	C	C	-
Red-bellied Woodpecker	X	B	B	Common Grackle	S	G	G
Red-headed Woodpecker	X	B	B	Brown-headed Cowbird	-	G	-
Hairy Woodpecker	X	B	B	<u>Thraupidae</u>			
Downy Woodpecker	X	B	B	Scarlet Tanager	C	C	-
<u>PASSERIFORMES</u>				Summer Tanager	C	C	-
<u>Tyrannidae</u>				<u>Fringillidae</u>			
Eastern Kingbird	T	F	-	Cardinal	S	S	S
Great Crested Flycatcher	U	F	-	Rose-breasted Grosbeak	C	C	-
Eastern Phoebe	B	F	-	Blue Grosbeak	S	S	-
Acadian Flycatcher	T	F	-	Indigo Bunting	H	S	-
Willow Flycatcher	T	F	-	Dickcissel	H	G	-
Least Flycatcher	T	F	-	Purple Finch	-	-	C
Eastern Wood Pewee	C	F	-	American Goldfinch	S	S	S
<u>Alaudidae</u>				Rufous-sided Towhee	S	G	G
Horned Lark	G	G	G	Grasshopper Sparrow	G	G	-
<u>Hirundinidae</u>				Henslow's Sparrow	H	G	-
Tree Swallow	U	F	-	Lark Sparrow	G	G	-
Bank Swallow	X	F	-	Dark-eyed Junco	-	-	G
Rough-winged Swallow	X	F	-	Tree Sparrow	-	-	G
Barn Swallow	B	F	-	Chipping Sparrow	S	G	-
Purple Martin	U	F	-	Field Sparrow	H	H	H
<u>Corvidae</u>				Harris' Sparrow	-	-	G
Blue Jay	C	C	S	White-crowned Sparrow	-	-	H
Common Crow	C	G	G	White-throated Sparrow	-	-	H
<u>Paridae</u>				Fox Sparrow	-	-	G
Black-capped Chickadee	U	C	C	Swamp Sparrow	-	-	G
Tufted Titmouse	U	C	C	Song Sparrow	-	-	G
<u>Sittidae</u>				Lapland Longspur	-	-	G
White-breasted Nuthatch	U	B	B	1. G=Ground, H=Herbaceous, S=Low Shrub,			
<u>Certhidae</u>				T=Midstory Shrub or Sapling, C=Canopy,			
Brown Creeper	-	-	B	X=Primary Cavity Excavator, U=Secondary			
<u>Troglodytidae</u>				Cavity User, B=Buildings, Structures.			
House Wren	U	S	-	2. G=Ground, H=Herbaceous, S=Shrub, C=Canopy,			
Bewick's Wren	U	S	-	B=Bark, F=Flycatching, W=Water.			
<u>Mimidae</u>							
Mockingbird	S	S	S				
Gray Catbird	S	S	-				
Brown Thrasher	S	S	-				

TABLE 5. Birds Found During the Breeding Season on the Grassland Study Areas, 1978-1980

Species	UNGRAZED				GRAZED			
	W/Food Strips		Untreated		R-1		R-2	
	W-4		W-5					
	No. Years Observed	Mean No. Terr.	No. Years Observed	Mean No. Terr.	No. Years Observed	Mean No. Terr.	No. Years Observed	Mean No. Terr.
Wood Duck	--	--	--	--	1	0	--	--
Red-tailed Hawk	--	--	--	--	2	0	1	0
American Kestrel	--	--	--	--	--	--	2	0.3
Bobwhite	3	0.3	2	0	3	1.0	3	1.0
Killdeer	--	--	1	0	1	0	--	--
Rock Dove	--	--	--	--	1	0	--	--
Mourning Dove	3	1.0	3	0.3	3	0.3	2	0.3
Yellow-billed Cuckoo	1	0.3	--	--	2	0	1	0
Chimney Swift	--	--	1	0	1	0	1	0
Common Flicker	1	0	2	0	2	0	--	--
Red-bellied Woodpecker	1	0	1	0	1	0	1	0
Red-headed Woodpecker	1	0	2	0.3	3	0.3	2	0
Hairy Woodpecker	1	0	--	--	--	--	1	0.3
Downy Woodpecker	--	--	--	--	1	0	1	0
Eastern Kingbird	3	1.3	3	0.7	3	0	3	0.3
Great Crested Flycatcher	2	0.3	1	0	2	0	2	0.3
Eastern Wood Pewee	1	0.3	--	--	1	0	--	--
Horned Lark	3	0.3	--	--	--	--	1	0
Rough-winged Swallow	1	0	1	0	1	0	1	0
Barn Swallow	2	0	2	0	1	0	1	0
Purple Martin	1	0	--	--	1	0	--	--
Blue Jay	1	0	2	0	2	0	3	0
Common Crow	1	0	--	--	2	0	1	0
Black-capped Chickadee	1	0	1	0	1	0	1	0
White-breasted Nuthatch	1	0	--	--	1	0	--	--
House Wren	2	0	--	--	3	0.5	--	--
Bewick's Wren	--	--	--	--	1	0.3	--	--
Mockingbird	--	--	--	--	1	0	--	--
Gray Catbird	1	0	1	0.3	3	1.0	--	--
Brown Thrasher	3	0.7	3	0.8	3	1.3	3	0.3
American Robin	3	0.3	1	0	2	0	1	0
Eastern Bluebird	--	--	1	0	1	0	--	--
Starling	--	--	--	--	3	0.3	1	0.3
White-eyed Vireo	--	--	--	--	1	0	--	--
Bell's Vireo	--	--	--	--	1	0.3	--	--
Yellow-throated Vireo	--	--	1	0	--	--	--	--
Common Yellowthroat	2	1.0	3	2.3	3	5.3	3	4.0
Yellow-breasted Chat	1	0.3	--	--	3	1.7	1	0.3
House Sparrow	1	0	1	0	1	0	--	--
Eastern Meadowlark	3	3.7	3	3.3	3	8.3	3	13.7
Red-winged Blackbird	3	5.7	3	4.3	3	9.7	3	29.3
Orchard Oriole	1	0.3	2	0	2	0.7	1	0
Northern Oriole	1	0.3	--	--	2	0.3	1	0
Common Grackle	3	0	2	0	3	0.3	2	0
Brown-headed Cowbird	2	0	2	0	3	0	1	0
Cardinal	2	0.7	2	0	3	3.3	3	0.3
Rose-breasted Grosbeak	--	--	1	0	--	--	1	0
Blue Grosbeak	2	0.3	2	1.0	3	1.0	2	0.7
Indigo Bunting	2	0.3	2	0.7	3	2.0	2	0.8
Dickcissel	3	3.7	3	4.5	3	9.3	3	23.3
American Goldfinch	2	0.3	2	0.3	3	0.7	1	0.3
Rufous-sided Towhee	1	0	1	0	1	0.7	1	0
Grasshopper Sparrow	3	4.0	3	1.3	3	7.5	3	11.8
Henslow's Sparrow	3	3.7	3	5.0	2	0.7	3	6.0
Chipping Sparrow	1	0	--	--	--	--	--	--
Field Sparrow	3	1.0	3	2.3	3	5.2	3	4.1
No. Nesting Species	23		15		25		20	
No. Species Observed Only	18		20		25		19	
Total Species	41		35		50		39	
Mean No. Territories	30.3		27.7		62.2		102.3	
Mean No. Territories/HA	2.0		1.7		3.1		3.5	

TABLE 6. Birds Found During the Breeding Season on the Woodland Study Areas, 1978-1980

Species	FORMERLY GRAZED		UNGRAZED				FOOD PLOT		CLEAR CUT		GIRDLED		UNTREATED			
	W-6		W-7		W-8		B-1		B-2		B-3		B-4		B-5	
	No. Years Observed	Mean No. Terr.	No. Years Observed	Mean No. Terr.	No. Years Observed	Mean No. Terr.	No. Years Observed	Mean No. Terr.	No. Years Observed	Mean No. Terr.	No. Years Observed	Mean No. Terr.	No. Years Observed	Mean No. Terr.	No. Years Observed	Mean No. Terr.
Wood Duck	1	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Red-tailed Hawk	2	0	2	0	--	--	2	0	--	--	2	0	--	--	--	--
Broad-winged Hawk	--	--	--	--	--	--	--	--	1	0	--	--	--	--	--	--
Bobwhite	3	0.3	3	0	--	--	--	--	--	--	--	--	--	--	--	--
Turkey	--	--	--	--	--	--	--	--	--	--	1	0	1	0	--	--
American Woodcock	1	0	2	0	--	--	--	--	--	--	--	--	--	--	--	--
Mourning Dove	3	0.7	3	1.3	1	0	--	--	1	0.3	--	--	--	--	--	--
Yellow-billed Cuckoo	3	1.7	3	3.7	3	2.7	1	0	1	0	1	0	1	0	2	0
Black-billed Cuckoo	1	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chuck-will's-widow	--	--	2	0	--	--	--	--	--	--	--	--	--	--	--	--
Whip-poor-will	1	0.3	--	--	2	0.3	--	--	--	--	--	--	--	--	1	0
Common Nighthawk	1	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ruby-throated Hummingbird	--	--	--	--	1	0	--	--	--	--	--	--	--	--	--	--
Common Flicker	1	0.5	3	0.7	1	0.3	--	--	--	--	1	0	--	--	2	0
Pileated Woodpecker	3	0.7	3	0.3	3	0.8	--	--	--	--	--	--	--	--	--	--
Red-bellied Woodpecker	3	3.0	2	0	2	1.0	--	--	1	0	3	1.0	3	0.3	3	0.7
Red-headed Woodpecker	3	1.3	3	0.3	2	0.7	--	--	--	--	2	0.7	1	0.3	1	0.3
Hairy Woodpecker	2	0	2	0.7	2	0.7	--	--	--	--	2	0	2	0	1	0
Downy Woodpecker	3	0.7	3	0.3	3	1.0	--	--	--	--	2	0	--	--	--	--
Eastern Kingbird	3	1.0	2	0.7	--	--	--	--	--	--	--	--	--	--	--	--
Great Crested Flycatcher	3	3.2	3	2.0	2	1.0	--	--	1	0	3	1.0	2	0.7	3	2.0
Eastern Phoebe	1	1.0	--	--	--	--	--	--	1	0	1	0	--	--	--	--
Acadian Flycatcher	--	--	--	--	1	0.3	--	--	--	--	--	--	--	--	--	--
Least Flycatcher	--	--	2	0.7	--	--	--	--	1	0.3	1	0.3	--	--	1	0
Eastern Wood Pewee	2	2.3	3	3.7	3	2.7	--	--	2	0.3	3	1.0	3	0.7	2	1.0
Blue Jay	3	1.7	3	3.3	3	3.3	1	0	2	0	2	0	3	0.3	3	0.7
Common Crow	--	--	2	0	--	--	--	--	--	--	1	0	--	--	--	--
Black-capped Chickadee	2	0	3	1.0	2	0.3	1	0	1	0	3	0.7	2	0.3	2	0.3
Tufted Titmouse	2	0.3	3	1.3	3	1.3	--	--	1	0	1	0.3	2	0.3	3	0.3
White-breasted Nuthatch	3	0.7	3	0	2	3.2	--	--	1	0	2	0.7	3	0.7	1	0.3
House Wren	1	0.3	3	1.3	--	--	--	--	--	--	--	--	--	--	--	--
Mockingbird	--	--	1	0	--	--	--	--	--	--	--	--	--	--	--	--
Gray Catbird	3	0.7	3	2.0	1	0	2	0.7	3	1.0	3	1.7	3	1.3	3	1.0
Brown Thrasher	3	1.0	3	0.7	1	0.3	1	0	2	0	2	0.3	1	0	--	--

TABLE 6 (continued)

American Robin	3	1.0	2	0.7	--	--	--	--	--	--	--	--	--
Wood Thrush	3	0.7	2	0	2	1.7	--	--	--	--	1	0	--
Eastern Bluebird	3	0.7	2	0	--	--	--	--	--	1	0.3	--	--
Blue-gray Gnatcatcher	2	0.3	2	0	2	0.3	2	0	2	0.3	1	0.3	--
Yellow-throated Vireo	--	--	1	0	1	0	--	--	--	1	0.3	--	--
Red-eyed Vireo	3	3.0	1	0	3	3.3	2	0	3	0.3	3	1.0	2
Black-and-white Warbler	--	--	--	--	2	0.3	--	--	--	--	--	--	2
Worm-eating Warbler	--	--	1	0.3	2	1.3	--	--	--	--	1	0.3	1
Blue-winged Warbler	1	0	--	--	--	--	1	0	--	--	--	--	0.3
Northern Parula	3	0.3	--	--	--	--	2	1.0	--	--	--	--	--
Ovenbird	2	0.7	1	0.3	3	5.3	--	--	--	--	3	1.3	2
Louisiana Waterthrush	3	0.3	--	--	--	--	--	--	--	--	--	--	0.7
Kentucky Warbler	2	0.8	--	--	2	0.7	1	0	3	0.7	3	0.7	1
Common Yellowthroat	2	0.7	3	3.3	1	0.3	1	0.3	--	--	--	--	0.3
Yellow-breasted Chat	--	--	3	1.3	--	--	--	--	--	--	--	--	--
House Sparrow	--	--	2	0	--	--	--	--	--	--	--	--	--
Eastern Meadowlark	1	0	--	--	--	--	--	--	--	--	--	--	--
Red-winged Blackbird	3	2.3	3	1.3	1	0	2	0.7	1	0	--	--	--
Orchard Oriole	2	0.7	--	--	--	--	--	--	--	--	--	--	--
Northern Oriole	3	1.3	2	1.3	1	0	--	--	1	0	--	1	0
Common Grackle	2	0.7	--	--	--	--	--	--	--	--	1	0	--
Brown-headed Cowbird	3	0	3	0	3	0	3	0	3	0	3	0	3
Scarlet Tanager	3	1.0	2	0	3	2.7	--	--	1	0	--	--	1
Summer Tanager	3	1.0	1	0	3	2.2	--	--	1	0.3	2	0.3	3
Cardinal	3	2.0	3	2.0	3	3.3	2	0.3	2	0.7	1	1.0	3
Rose-breasted Grosbeak	3	2.3	3	2.3	1	0.3	1	0	3	0.7	2	1.3	2
Blue Grosbeak	--	--	3	1.0	1	0	--	--	--	--	--	--	2
Indigo Bunting	3	1.3	3	4.0	2	0.3	3	1.0	3	1.0	2	1.7	1
American Goldfinch	2	0	2	0.7	--	--	--	--	--	--	--	--	1
Rufous-sided Towhee	1	1.0	3	2.0	3	2.0	3	0.7	3	1.3	2	1.3	3
Field Sparrow	2	0.3	3	3.3	2	0.7	2	0.7	1	0	1	0.3	3
No. Nesting Species	40		31		31		8		12		21		17
No. Species Observed Only	11		17		8		11		15		11		8
Total Species	51		48		39		19		27		32		25
Mean No. Territories	43.8		48.0		42.8		6.3		7.3		12.3		12.0
Mean No. Territories/HA	2.7		7.0		2.6		5.3		2.3		5.6		7.5

TABLE 12. Birds Found During the Wintering Season on the Woodland Study Areas, 1979-1981

Species	FORMERLY GRAZED		UNGRAZED				FOOD PLOT		CLEAR CUT		GIRDLED		UNTREATED			
	W-6		W-7		W-8		B-1		B-2		B-3		B-4		B-5	
	No. Years Observed	Mean	No. Years Observed	Mean	No. Years Observed	Mean	No. Years Observed	Mean	No. Years Observed	Mean	No. Years Observed	Mean	No. Years Observed	Mean	No. Years Observed	Mean
Red-tailed Hawk	--	--	--	--	--	--	1	0.2	--	--	--	--	--	--	--	--
Bobwhite	--	--	1	4.0	--	--	--	--	--	--	--	--	--	--	--	--
Turkey	1	0.1	--	--	--	--	1	0.5	--	--	--	--	--	--	--	--
Great Horned Owl	1	0.1	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Common Flicker	2	0.3	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Pileated Woodpecker	--	--	1	0.2	1	0.3	--	--	--	--	--	--	--	--	--	--
Red-bellied Woodpecker	3	1.6	2	0.7	1	0.3	--	--	--	--	--	--	--	--	--	--
Red-headed Woodpecker	1	0.8	1	2.3	--	--	--	--	--	--	1	0.7	1	1.7	1	1.0
Hairy Woodpecker	2	2.2	3	0.7	1	0.2	--	--	--	--	--	--	1	0.1	--	--
Downy Woodpecker	3	1.2	2	0.3	2	1.0	1	0.1	1	0.1	1	0.1	--	--	--	--
Blue Jay	3	3.8	3	3.9	2	0.4	1	0.2	1	0.1	--	--	--	--	1	0.3
Black-capped Chickadee	2	0.8	1	1.0	2	0.7	1	0.1	--	--	--	--	1	0.2	1	0.2
Tufted Titmouse	--	--	1	0.2	--	--	2	0.4	--	--	--	--	--	--	--	--
White-breasted Nuthatch	3	3.3	3	1.1	2	0.7	--	--	--	--	--	--	1	0.1	2	0.3
Brown Creeper	1	0.1	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Mockingbird	1	0.3	--	--	--	--	--	--	--	--	--	--	--	--	--	--
American Robin	1	0.3	--	--	1	0.3	--	--	--	--	--	--	1	1.7	--	--
Starling	--	--	1	0.3	--	--	--	--	--	--	--	--	--	--	--	--
Cardinal	2	0.7	3	1.8	--	--	--	--	1	0.1	1	0.3	--	--	1	0.2
Purple Finch	--	--	1	5.0	--	--	--	--	--	--	--	--	--	--	--	--
American Goldfinch	1	0.9	1	0.7	--	--	1	1.0	--	--	1	0.1	--	--	1	0.1
Dark-eyed Junco	3	3.8	2	5.7	--	--	3	18.1	1	0.2	--	--	--	--	--	--
Tree Sparrow	2	1.2	--	--	--	--	2	0.6	--	--	--	--	--	--	--	--
Field Sparrow	--	--	1	1.2	--	--	--	--	--	--	--	--	--	--	--	--
Song Sparrow	2	0.6	--	--	--	--	--	--	--	--	--	--	--	--	--	--
No. Species Observed	18		16		8		9		4		4		5		6	
Mean No. Birds	22.0		29.0		3.7		20.9		0.4		1.2		3.8		2.2	
Mean No. Birds/HA	1.4		4.2		0.2		17.5		0.1		0.5		1.6		1.3	

APPENDIX I

	FORAGING PATTERN ²				FORAGING PATT ²		
	Nest ¹	Breeding			Nest ¹	Breeding	
	Site	Season	Winter		Site	Season	Winte
<u>ANSERIFORMES</u>				<u>Turdidae</u>			
Blue-winged Teal	H	W	-	American Robin	S	G	S
Wood Duck	U	W	-	Wood Thrush	T	S	-
<u>FALCONIFORMES</u>				Eastern Bluebird			
Red-tailed Hawk	C	H	H	<u>Sylviidae</u>			
Broad-winged Hawk	C	H	-	Blue-gray Gnatcatcher	T	C	-
Marsh Hawk	H	H	H	<u>Bombycillidae</u>			
American Kestrel	U	F	H	Cedar Waxwing	-	-	S
<u>GALLIFORMES</u>				<u>Laniidae</u>			
Bobwhite	G	G	G	Loggerhead Shrike	T	H	H
Turkey	G	G	G	<u>Sturnidae</u>			
<u>CICONIIFORMES</u>				Starling	U	G	G
Green Heron	C	W	-	<u>Vireonidae</u>			
<u>CHARADRIIFORMES</u>				White-eyed Vireo	S	S	-
Killdeer	G	G	-	Bell's Vireo	S	S	-
American Woodcock	G	G	-	Yellow-throated Vireo	C	C	-
Spotted Sandpiper	G	G	-	Red-eyed Vireo	C	C	-
<u>COLUMBIFORMES</u>				<u>Parulidae</u>			
Rock Dove	B	G	G	Black & White Warbler	G	C	-
Mourning Dove	T	G	G	Worm-eating Warbler	G	S	-
<u>CUCULIFORMES</u>				Blue-winged Warbler	T	C	-
Yellow-billed Cuckoo	T	C	-	Northern Parula	C	C	-
Black-billed Cuckoo	S	S	-	Yellow Warbler	S	C	-
<u>CAPRIMULGIFORMES</u>				Yellow-rumped Warbler	-	-	C
Chuck-will's Widow	G	F	-	Ovenbird	G	G	-
Whip-poor-will	G	F	-	Louisiana Waterthrush	G	G	-
Common Nighthawk	G	F	-	Kentucky Warbler	S	S	-
<u>APODIFORMES</u>				Common Yellowthroat	H	S	-
Chimney Swift	B	F	-	Yellow-breasted Chat	S	S	-
Ruby-throated Hummingbird	T	H	-	<u>Ploceidae</u>			
<u>STRIGIFORMES</u>				House Sparrow	B	G	G
Great Horned Owl	U	H	H	<u>Icteridae</u>			
Short-eared Owl	-	-	H	Eastern Meadowlark	G	H	H
<u>PICIFORMES</u>				Red-winged Blackbird	H	H	H
Common Flicker	X	B	B	Orchard Oriole	T	C	-
Pileated Woodpecker	X	B	B	Northern Oriole	C	C	-
Red-bellied Woodpecker	X	B	B	Common Grackle	S	G	G
Red-headed Woodpecker	X	B	B	Brown-headed Cowbird	-	G	-
Hairy Woodpecker	X	B	B	<u>Thraupidae</u>			
Downy Woodpecker	X	B	B	Scarlet Tanager	C	C	-
<u>PASSERIFORMES</u>				Summer Tanager	C	C	-
<u>Tyrannidae</u>				<u>Fringillidae</u>			
Eastern Kingbird	T	F	-	Cardinal	S	S	S
Great Crested Flycatcher	U	F	-	Rose-breasted Grosbeak	C	C	-
Eastern Phoebe	B	F	-	Blue Grosbeak	S	S	-
Acadian Flycatcher	T	F	-	Indigo Bunting	H	S	-
Willow Flycatcher	T	F	-	Dickcissel	H	G	-
Least Flycatcher	T	F	-	Purple Finch	-	-	C
Eastern Wood Pewee	C	F	-	American Goldfinch	S	S	S
<u>Alaudidae</u>				Rufous-sided Towhee	S	G	G
Horned Lark	G	G	G	Grasshopper Sparrow	G	G	-
<u>Hirundinidae</u>				Henslow's Sparrow	H	G	-
Tree Swallow	U	F	-	Lark Sparrow	G	G	-
Bank Swallow	X	F	-	Dark-eyed Junco	-	-	G
Rough-winged Swallow	X	F	-	Tree Sparrow	-	-	G
Barn Swallow	B	F	-	Chipping Sparrow	S	G	-
Purple Martin	U	F	-	Field Sparrow	H	H	H
<u>Corvidae</u>				Harris' Sparrow	-	-	G
Blue Jay	C	C	S	White-crowned Sparrow	-	-	H
Common Crow	C	G	G	White-throated Sparrow	-	-	H
<u>Paridae</u>				Fox Sparrow	-	-	G
Black-capped Chickadee	U	C	C	Swamp Sparrow	-	-	G
Tufted Titmouse	U	C	C	Song Sparrow	-	-	G
<u>Sittidae</u>				Lapland Longspur	-	-	G
White-breasted Nuthatch	U	B	B	1. G=Ground, H=Herbaceous, S=Low Shrub, T=Midstory Shrub or Sapling, C=Canopy, X=Primary Cavity Excavator, U=Secondary Cavity User, B=Buildings, Structures.			
<u>Certhidae</u>				2. G=Ground, H=Herbaceous, S=Shrub, C=Canopy, B=Bark, F=Flycatching, W=Water.			
Brown Creeper	-	-	B				
<u>Troglodytidae</u>							
House Wren	U	S	-				
Bewick's Wren	U	S	-				
<u>Mimidae</u>							
Mockingbird	S	S	S				
Gray Catbird	S	S	-				
Brown Thrasher	S	S	-				